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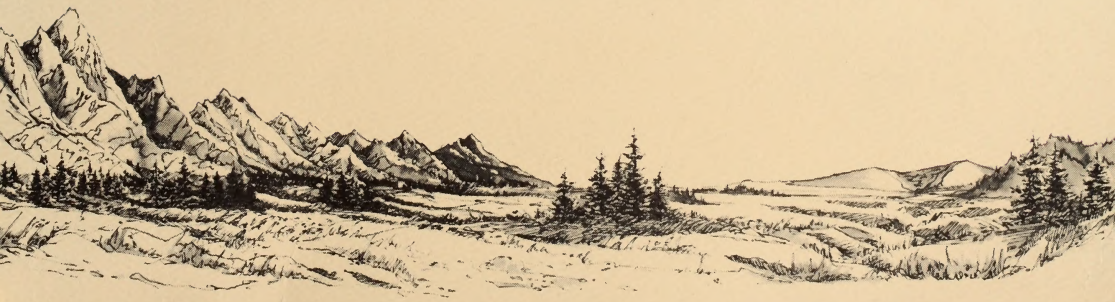
Final Report

WILDLIFE RESOURCE INVENTORY OF THE CHACO STRIPPABLE COAL AREA, NEW MEXICO

PR-40-1

BIO/WEST, Inc.

Aquatic and Terrestrial
Resource Management and Problem Solving



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Final Report

WILDLIFE RESOURCE INVENTORY OF THE CHACO STRIPPABLE COAL AREA, NEW MEXICO

PR-40-1

Submitted to

Bureau of Land Management
Albuquerque District Office
3550 Pan American Freeway, NE
P. O. Box 6770
Albuquerque, NM 87107

Contract No. YA-553-CTO-1072

Prepared by

Michael H. Albee
Project Manager

Submitted by

BIO/WEST, Inc.
P. O. Box 3226
Logan, Utah 84321

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February 1982

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The successful completion of the Chaco Strippable Coal Area Wildlife Inventory necessitated the assistance of a large number of individuals in a variety of disciplines and professions. This program required the continued cooperation of key personnel to minimize the influence of problems inherent in projects of this size.

I would like to express my appreciation for a job well done to all BIO/WEST team members named below on the project roster. They represent a professional team of the highest caliber.

I am especially grateful to Mr. James Ramakka, BLM Biologist and Project Inspector who was always available to provide technical and managerial assistance. His understanding of the problems involved in field studies of this scope and magnitude and his continual efforts to help find solutions were essential to completion of this project.

To all those individuals who provided their time, information, and experience, a blanket thank you, however inadequate, must suffice.

ROSTER OF BIO/WEST PROJECT PERSONNEL AND PROJECT RESPONSIBILITY

Michael H. Albee	Project Manager[1]
Nancy J. Hubbard	Project Secretary
Gerald C. Hughes	Project Cartographer
Thomas M. Campbell	Herpetological Survey[2]
Tim W. Clark	Herpetological Survey
Timothy H. Craig	Avian and Vegetation Survey
Erica H. Craig	Avian and Vegetation Survey
Edward T. Steele	Avian and Vegetation Survey
Thomas W. Fratt	Mammal Survey
S. Blaise Chanson	Mammal Survey

Technicians

Barbara A. Blakesley	Mammal Survey
Bruce Ackerman	"
Kathleen M. Holmes	"
Jeffrey J. Grenier	"
John H. Hoak	"

---

[1]Principle author of final report except those sections indicated.

[2]Principal author of Herpetological Section.

GENERAL INTRODUCTION

The rangelands of western United States have traditionally sustained abundant and varied wildlife populations. During the past decades, however, multipurpose utilization of these lands has been increasing at a rapid rate, frequently resulting in substantial alterations of existing wildlife habitat.

Since the passage and institutionalization of environmental protection laws, mandates exist requiring federal agency responsibility for the inventory/assessment of existing resources, and the projection and amelioration of the impact of habitat alterations on the terrestrial ecosystem. The first step in a program of environmental accountability is an appraisal of the existing environment in defined resource areas, so the significant wildlife habitat and species components can be delineated and described.

To comply with regulations, specifically the Federal Land Policy and Management Act of 1976, the Bureau of Land Management's Albuquerque District contracted with BIO/WEST, Inc., to conduct a wildlife resource inventory of lands within the Chaco Planning Unit of the Farmington Resource Area. Data from this inventory, which encompasses 442,000 acres of potential coal lease sites, will provide "Bureau" personnel with the baseline knowledge necessary for updating land use plans, developing habitat management plans, and identifying the impacts of coal recovery on the area's wildlife resources.

The following final report presents the results of the wildlife resource inventory from its initiation on July 18, 1980, to completion

on September 1, 1981. A considerable quantity of information was generated during this study. Portions of the compiled data are included in appendices; to facilitate use of this document, data summaries are given in the primary text. In the interest of clarity, each program element or task is presented as a separate, independent section. The seven specific tasks which were completed are:

Task 1 - Hypothetical Species List

Task 2 - Significant Species List

Task 3 - Life-Form Analysis

Task 4 - Special Habitat Feature Inventory

Task 5 - Animal Occurrence Survey

Task 6 - Scaled Quail Habitat Evaluation

Task 7 - Pronghorn Antelope Habitat Evaluation

PURPOSE OF INVENTORY

Decisions concerning uses of the land which may directly or indirectly effect the existing environment require a thorough knowledge of all resources involved. Wildlife inventories provide land managers with sufficient baseline information necessary to insure that wildlife receive adequate consideration in the decision-making process. The Bureau of Land Management has developed inventory standards, levels, and reporting requirements designed to provide such information. BLM manual 6602 - Integrated Habitat Inventory and Classification System sets forth a system of habitat inventory and classification which integrates selected data on wildlife, vegetation, soils, land form, climate, and other ecosystem determinants and considers their interrelationships within geographically defined areas. It is the basic wildlife habitat data collecting and organizing system used in considering wildlife resources in the analytical, planning, and decision-making process of the BLM, including Environmental Assessment Records, Environmental Impact Statements, land use plans and other reports. Instruction Memoranda WO-79-391 and WO-80-3 establish wildlife inventory standards, levels, and reporting requirements depending on the intended specific uses of the information collected. The Chaco Strippable Coal Wildlife Resource Inventory is designed to comply with the reporting standards of BLM Manual 6602 and the level set forth in Instruction Memoranda WO-79-391 and WO-80-3.

The specific objectives of the inventory are:

1. Produce a hypothetical wildlife species list.
2. Produce a significant wildlife species list.
3. Produce a life-form matrix for all significant species.
4. Complete a special habitat feature inventory.
5. Complete an animal occurrence survey for amphibians, birds, fishes, mammals, and reptiles.
6. Complete a habitat evaluation for scaled quail and pronghorn.

STUDY AREA

The inventory area lies within the Bureau of Land Management's Chaco Planning Unit of the Farmington Resource Area, New Mexico. The planning unit, as a whole, contains approximately 2,797,756 acres of land, of which 18.7% is publically owned and administered by BLM; the remaining is private, state, Indian land administered by Bureau of Indian Affairs and public land administered by National Park Service. The primary inventory area totals about 442,000 acres in three separate tracts of land in San Juan, McKinley and Sandoval counties. Located about half way between Farmington and Albuquerque, the main body of the study area is in the shape of an irregular, narrow band extending from northwest to southeast. The two other tracts of land are in blocks to the south of the main body as shown in Figure 1.

The planning unit lies within the San Juan Basin at an elevation of 5,000-7,000 feet. Local relief seldom exceeds a few hundred feet. The area is best characterized as a dissected plateau, the surface of which slopes gently westward. Major features are low mesas and broad cuestas. Badlands of barren, colorful shale hills are prominent throughout the study area, most noteably in the northwest toward Bisti. Principle intermittent streams in the drainage system of the Chaco River have cut into the plateau to form steep-sided canyon walls. Stabilized sand dunes occur on the upland plains throughout the study area, and active dunes can be found near Kimbeto and Eagle Mesa (Figure 2).

The basic unit used for sampling was the standard habitat site (SHS). These SHS's were designated by Farmington Resource Area field

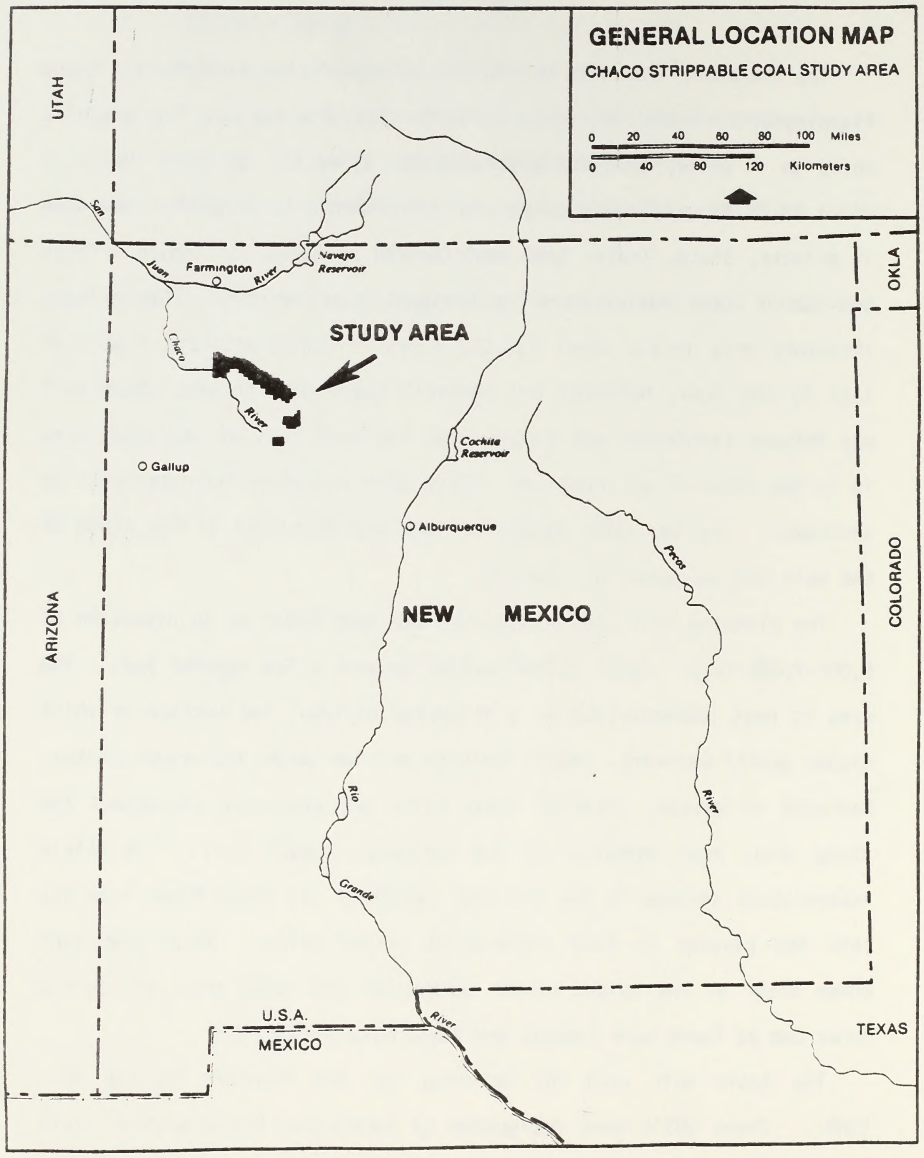
GENERAL LOCATION MAP
CHACO STRIPPABLE COAL STUDY AREA
0 20 40 60 80 100 Miles
0 40 80 120 Kilometers
UTAH
OKLA
COLORADO
ARIZONA
NEW MEXICO
TEXAS
U.S.A.
MEXICO
STUDY AREA
Farmington
San Juan River
Navajo Reservoir
Chaco River
Gallup
Cochiti Reservoir
Albuquerque
Pecos River
Rio Grande River

Figure 1

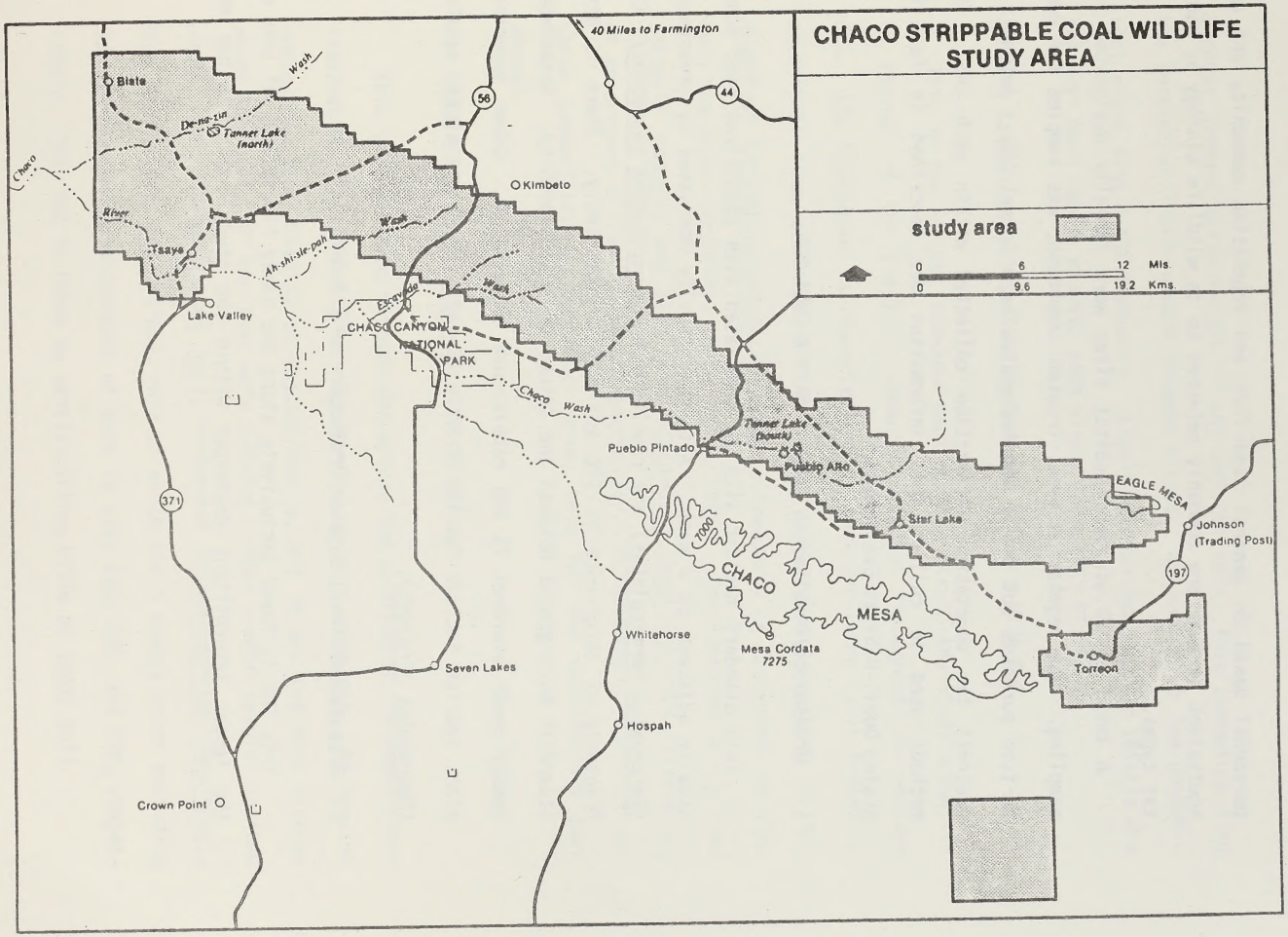
CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
study area
0 6 12 Mls.
0 9.6 19.2 Kms.
40 Miles to Farmington
Blate
Wash
De-na-zin
Tanner Lake (north)
Chaco
River
Tsaye
Ah-shi-sle-pah
Wash
Kimbeto
56
44
Lake Valley
Escavada
Wash
CHACO CANYON NATIONAL PARK
Chaco Wash
Pueblo Pintado
Tanner Lake (south)
Pueblo ARC
Star Lake
EAGLE MESA
Johnson (Trading Post)
197
371
CHACO
MESA
Whitehorse
Mesa Cordata 7275
Torreon
Seven Lakes
Hospah
Crown Point

Figure 2

personnel based on general land form and vegetation community and are equivalent to what are commonly referred to in wildlife biology as habitat types.

A total of 10 standard habitat sites were formally designated for sampling. One vegetation type, treated sagebrush, was sampled for comparison purposes but it is not designated as a formal SHS. Appendix A presents the vegetation information collected within each SHS. The methods used to collect this information are described in Task 6, Scaled Quail Habitat Evaluation.

1. Greasewood/Rabbitbrush Dunes - SAVE 4 CHNA SDN

This standard habitat site is associated with stabilized sand dunes usually adjacent to a wash. Although visually dominated by greasewood (Sarcobatus vermiculatus) and rabbitbrush (Chrysothamnus nauseosus), the frequency of occurrence is 14% and 1.3%, respectively. There is considerable bare ground between the shrubs of this community. Greasewood canopy cover averages 7% and rabbitbrush averages 4%. Other important plant species include Russian thistle (Salsola kali) and alkali sacaton (Sporobolus airoides).

2. Greasewood/Alkali Sacaton Drainage - SAVE 4 SPAI ARY

This SHS is found exclusively along the sandy floodplains of some of the larger intermittent drainages within the study area. It has the

highest average shrub height of any SHS (66 cm). This community also has considerable bare ground between plants. Greasewood is the predominant plant with a 46% frequency. Alkali sacaton and Russian thistle are the next most common plants, each with a frequency of 44%.

3. Big Sagebrush/Galleta Rolling Uplands - ARTR 2 HIJA RUP

This is the largest standard habitat site within the study area. It is typical of the sagebrush communities found throughout the western U.S. Its topography is characterized by gently-rolling hills broken by occasional rock outcrops and drainages. The dominant shrub is big sagebrush (Artemisia tridentata) with a frequency of occurrence of 71%. Very few other shrubs are to be found. Other common species are galleta (Hilaria jamesii) and blue grama (Bouteloua gracilis) with a frequency of occurrence of 79% and 56%, respectively. As is common in most of the shrub communities in the study area, this SHS has considerable bare ground.

4. Mixed Shrub Rolling Uplands - MX SH RUP

This is the second largest SHS within the study area. Without close examination it can easily be mistaken for a pure grassland. No species dominate either visually or vegetationally, and it was the most diverse plant community of any that were sampled. Most common species include rabbitbrush (Chrysothamnus sp.), snakeweed (Xanthocephalum sarothrae), Russian thistle, and galleta, none of which has a canopy cover exceeding 5%. Frequency of occurrence of each is 27%, 48%, 48%, and 27%, respectively. This SHS is found on gently-rolling hills on sandy soil.

5. Snakeweed/Galleta Uplands - XASA HIJA UPL

This is one of the less diverse communities in both number of plant species and structural complexity. Snakeweed, galleta, and Russian thistle are, by far, the dominant plants with frequencies of 79, 68, and 53%, respectively.

This type is usually confined to the top of rolling hills with sandy soils.

6. Ricegrass/Snakeweed Dunes - ORHY XASA 2 SDN

This SHS is most often found on stabilized sand dunes and occurs only in the northwestern one quarter of the study area. It has a low diversity of both plant species and vertical cover structure. The dominant plants are ricegrass (Oryzopsis hymenoides) and snakeweed with a frequency of occurrence of 72% and 49%, respectively.

7. Alkali Sacaton/Annual Atriplex Swale - SPAI ATRIP SWL

This is another SHS of low plant species diversity and little overhead cover structure. It is the closest to a grassland community of any SHS. It occurs exclusively in swales between rolling hills. Alkali sacaton (39% frequency of occurrence) provides a large portion of the plant cover present although Russian thistle has a higher frequency of occurrence (44%). Annual atriplex (Atriplex saccaria) has a frequency of occurrence of 20% but it provides less than 2% cover.

8. Pinyon-Juniper/Sagebrush Hills - PJ ARTR 2 HIL

This SHS is most often associated with a rocky bluff or mesa. It is dominated by big sagebrush (58% frequency of occurrence) and has scattered pinyon (Pinus edulis) and juniper (Juniperus sp.) trees at a relatively low density. Juniper is more common with a frequency of occurrence of 7%. Pinyon occurs at less than 1%. The associated plant species are very similar to the big sagebrush-galleta rolling uplands SHS with a high frequency of blue grama (50%) and galleta (32%).

9. Pinyon-Juniper Hills - PIED JUNIP HIL

Chaco Mesa in the southern part of the study area is the only place where this standard habitat site is found. It is characterized by course rocky soil and little understory vegetation. There is extensive bare ground between the relatively low density of pinyon and juniper (frequency of occurrence 3.5 and 18%, respectively). Juniper provides 11.5% canopy cover and pinyon cover is less than 2%. Other common plant species include sagebrush (Artemisia sp.), snakeweed, and galleta.

10. Badlands - ERIOG SAKAT BAL

The only vegetation occurring in this standard habitat site is found in the draws. Buckwheat (Eriogonum sp.), greasewood, Russian thistle, and three species of saltbush (Atriplex obovata, A. saccaria, and A. confertifolia) are the most common, none of which exceed 1% in canopy

cover. Collectively, the saltbushes have a frequency of occurrence of 12%. The other plant species are less than 5% in frequency of occurrence. Badlands are characterized by steep clay hills bisected by deep and narrow washes.

11. Treated Sagebrush

This vegetation was not formally designated as a standard habitat site but limited small mammal trapping was conducted within it for comparison purposes. It was a severly overgrazed site with a sparse stand of big sagebrush which had been treated (1959) to increase the grasses. Galleta and blue grama are the most common grasses.

TASK 1 - HYPOTHETICAL SPECIES LIST

This is a list of species which presently are expected to occur or historically were expected to occur on the study area.

HYPOTHETICAL LIST OF SPECIES
CHACO STRIPPABLE COAL AREA

Letter Code	Common Name	Scientific Name	Reference	Life Form
	AMPHIBIANS			
AMTUIT	Utah Tiger Salamander	*Ambystoma tigrinum utahensis*	6, 9[1]	1
AMTINE	Arizona or Clouded Tiger Salamander	*A. t. nebulosum*	6, 9	1
RAPI	Leopard Frog	*Rana pipiens*	9	1
PSTRTR	Western Chorus Frog	*Pseudacris triseriata triseriata*	9	1
SCHA	Western Spadefoot	*Scaphiopus hammondi*	6, 9	1
SCINT	Great Basin Spadefoot	*Scaphiopus intermontanus*	6, 9	1
SCBO	Plains Spadefoot	*S. bombifrons*	6, 9	1
BUWOAU	Southwestern Woodhouse's Toad	*Bufo woodhousei australis*	9	1
BUPU	Red-spotted Toad	*B. punctatus*	9	1
BUCOG	Great Plains Toad	*B. cognatus*	9	1
BUWOWO	Rocky Mountain Toad	*B. woodhousei woodhousei*	9	1
HYAR	Canyon Treefrog	*Hyla arenicolor*	9	1
	REPTILES			
TEOR	*Western Box Turtle	*Terrapene ornata*	6	4
PHDO	*Desert Shorthorned Lizard	*Phrynosoma douglassi ornatissimum*	9	4
PHDOHE	Mountain Shorthorned Lizard	*P. d. hernandesi*	6, 9	4
HOMA	Lesser Earless Lizard	*Holbrookia maculata*	6, 9	4
GAWI	Leopard Lizard	*Gambelia wislizenii*	9	4
CRCO	*Collared Lizard	*Crotaphytus collaris*	6, 9	3
UTSTSTE	Desert Sideblotched Lizard	*Uta stansburiana stejnegeri*	6, 9	3
UTSTSTA	Northern Sideblotched Lizard	*U. s. stansburiana*	6, 9	3

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	REPTILES (Continued)			
URORWR	Northern Tree Lizard	Urosaurus ornatus wrighti	6, 9	5
SCGRA	Sagebrush Lizard	Sceloporus graciosus	6, 9	4
SCUNEL	Northern Plateau Lizard	Sceloporus undulatus elongatus	6, 9	4
SCUNTR	Southern Plateau Lizard	S. u. tristichus	9	4
SCMACE	Orange-headed Spiny Lizard	Sceloporus magister cephaloflavus	9	4
EUOB	Great Plains Skink	Eumeces obsoletus	9	2
EUMUEP	Southern Many-lined Skink	E. multivirgatus epipleurotus	9	2
CNTISE	Northern Whiptail	Cnemidophorus tigris septentrionalis	9	4
CNVE	*Plateau Striped Whiptail	C. velox	6	4
CNIN	Little Striped Whiptail	C. inornatus	9	4
MAFLTE	Western Coachwhip	Masticophis flagellum testaceus	6, 9	4
LATRCE	New Mexico Milk Snake	Lampropeltis triangulum celaenops	9	4?
MATATA	Striped Desert Whipsnake	Masticophis taeniatus taeniatus	6, 9	4
BIPURE	Regal Ringneck Snake	Diadophis punctatus regalis	9	2
PIMEDE	Great Basin Gopher Snake	Pituophis melanoleucus deserticola	6, 9	4
PINEAF	Sonoran Gopher Snake	P. m. affinis	6, 9	4
ARELPH	Painted Desert Glossy Snake	Arizona elegans philipi	6, 9	4?
HYTOLO	Mesa Verde Night Snake	Hypsiglena torquata loreala	6, 9	4
HYTOOC	Spotted Night Snake	H. t. ochrorhyncha	6, 9	4
HYTOTE	Texas Night Snake	H. t. texana	6, 9	4

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	REPTILES (Continued)			
HENANA	Plains Hognose Snake	Heterodon nasicus nasicus	9	4?
SAGRGR	Mountain Patch-nosed Snake	Salvadora grahamiae grahamiae	9	4?
THCYCY	Blacknecked Western Garter Snake	Thamnophis cyrtopsis cyrtopsis	9	2
THELVA	Wandering Garter Snake	Thamnophis elegans vagrans	6, 9	4
CAVIVI	Prairie Rattlesnake	Crotalus viridus viridus	6, 9	4
CRMO	Black-tailed Rattlesnake	C. molossus	9	4
CRAT	Western Diamondback Rattlesnake	C. atrox	9	4
	BIRDS			
CAAU	*Turkey Vulture	Cathartes aura		3
ACGE	*Goshawk	Accipiter gentilis	4, 7	10
ACCO	*Cooper's Hawk	Accipiter cooperii	7	10
ACST	*Sharp-shinned Hawk	Accipiter striatus	4, 7	10
CICY	*Northern Harrier	Circus cyaneus	7	4
BULA	*Rough-legged Hawk	Buteo lagopus	7	4
BUREG	*Ferruginous Hawk	Buteo regalis	7	3
BUJA	*Red-tailed Hawk	Buteo jamaicensis	7	11
BUSW	*Swainson's Hawk	Buteo swainsoni	7	6
AQCH	*Golden Eagle	Aquila chrysaetos	7	11
FAME	*Prairie Falcon	Falco mexicanus	7	3
FACO	*Merlin	Falco columbaris	7	10
FASP	*American Kestrel	Falco sparverius	7	13
CASQ	*Scaled Quail	Callipepla squamata	7	4

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	BIRDS (Continued)			
EUMO	*Mountain Plover	Eupoda montana	12	4
COLE	Rock Dove	Columba livia	7	3
ZEMA	*Mourning Dove	Zenaidura macroura	7	10
GECA	Roadrunner	Geococcyx californianus	4	4
OTAS	*Screech Owl	Otus asio	7	13
BUVIR	*Great Horned Owl	Bubo virginianus	7	11
ASOT	*Long-eared Owl	Asio otus	7	10
ASFL	*Short-eared Owl	Asio flammeus	7	4
SPCU	*Burrowing Owl	Speotyto cunicularia	7	14
OTFL	*Flammulated Owl	Otus flammeolus	7	13
PHNU	Poor-will	Phalaenoptilus nuttalli	7	5
CHMI	Common Nighthawk	Chordeiles minor	7	5
AESA	White-throated Swift	Aeronautes saxatalis	7	3
SEPL	Broad-tailed Hummingbird	Selasphorus platycercus	9	6
ARAL	Black-chinned Hummingbird	Archilochus alexandri	9	6
SERU	Rufous Hummingbird	Selasphorus rufus	7	10
COAU	Common Flicker	Colaptes auratus	7	12
DESC	Ladderbacked Woodpecker	Dendrocopos scalaris	7	12
MEFO	Acorn Woodpecker	Melanerpes formicivorus	7	12
SPVAR	Yellow-bellied Sapsucker	Sphyrapicus varius	7	12
SPTH	Williamson's Sapsucker	Sphyrapicus thyroideus	7	12
DEVI	Hairy Woodpecker	Dendrocopos villosus	7	12
DEPU	Downy Woodpecker	Dendrocopos pubescens	7	12
TYVO	Cassin's Kingbird	Tyrannus vociferans	7, 9	10

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	BIRDS (Continued)			
TYVE	Western Kingbird	Tyrannus verticalis	7	10
MYCI	Ash-throated Flycatcher	Myiarchus cinerascens	7	13
SASA	Say's Phoebe	Sayornis saya	7, 9	3
EMOB	Dusky Flycatcher	Empidonax oberholseri	7	7
COSO	Western Wood Pewee	Contopus sordidulus	7	10
ERAL	Horned Lark	Eremophila alpestris	7, 8	4
HIRU	Barn Swallow	Hirundo rustica	7	3
PEPY	Cliff Swallow	Petrochelidon pyrrhonota	7, 9	3
IRBI	Tree Swallow	Iridoprocne bicolor	7	13
RIRI	Bank Swallow	Riparia riparia	7	15
STRU	Rough-winged Swallow	Stelgidopteryx ruficollis	7	15
PRSU	Purple Martin	Progne subis	7	13
CYST	Steller's Jay	Cyanocitta stelleri	7	10
APCO	Scrub Jay	Aphelocoma coerulescens	7	7
GYCY	Pinyon Jay	Gymnorhinus cyanocephala	7	9
PIPI	Black-billed Magpie	Pica pica	7	6
COCOR	Common Raven	Corvus corax	7	3
COCR	White-necked Raven	Corvus cryptoleucus	4	10
COBRA	Common Crow	Corvus brachyrhynchos	4, 7	10
PAGA	Mountain Chickadee	Parus gambeli	4, 7	13
SICAR	White-breasted Nuthatch	Sitta carolinensis	7	12
TRAE	House Wren	Troglodytes aedon	7	13
THBE	Bewick's Wren	Thryomanes bewickii	7	13
SOABS	Rock Wren	Salpinctes obsoletus	7	3

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	BIRDS (Continued)			
CAMEXI	Canyon Wren	Catherpes mexicanus	7	3
MIPO	Mockingbird	Mimus polyglottos	7, 8	6
TORU	Gray Catbird	Dumetella carolinensis	4, 7	6
TORUF	Brown Thrasher	Toxostoma rufum	4, 7	6
ORMO	Sage Thrasher	Oreoscoptes montanus	9	6
TUMI	American Robin	Turdus migratorius	7	6
MYTO	Townsend's Solitaire	Myadestes townsendi	7	5
HYGU	Hermit Thrush	Hylocichla guttata	7	4
SIME	Western Bluebird	Sialia mexicana	7	13
LALU	*Loggerhead Shrike	Lanius ludovicianus	7, 8, 9	6
STVU	Starling	Sturnus vulgaris	7	13
VIHU	*Hutton's Vireo	Vireo huttoni	4	10
VIGI	Warbling Vireo	Vireo gilvus	7	10
VEVI	Virginia's Warbler	Vermivora virginiae	7	5
DETO	Townsend's Warbler	Dendroica townsendi	7	9
DENI	Black-throated Gray Warbler	Dendroica nigrescens	7	9
PADO	*House Sparrow	Passer domesticus	7	13
STNEG	Western Meadowlark	Sturnella neglecta	7	4
EUCY	Brewer's Blackbird	Euphagus cyanocephalus	7	6
CAME	Boat-tailed Grackle	Cassidix mexicanus	7	6
QUQU	Common Grackle	Quiscalus quiscula	4, 7	6
MOAT	Brown-headed Cowbird	Molothrus ater	7	6
ICBU	Northern Oriole	Icterus bullockii	7	8
PILU	Western Tanager	Piranga ludoviciana	9	9

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	BIRDS (Continued)			
PIFL	Hepatic Tanager	*Piranga flara*	7	10
PHME	Black-headed Grosbeak	*Pheucticus melanocephalus*	7	10
HEVE	Evening Grosbeak	*Hesperiphona vespertina*	7	10
PAAMO	Lazuli Bunting	*Passerina amoena*	7	7
CAPU	Purple Finch	*Carpodacus purpureus*	4	10
CAMEX	House Finch	*Carpodacus mexicanus*	7	8
SPPI	Pine Siskin	*Spinus pinus*	7	10
SPPS	Lesser Goldfinch	*Spinus psaltria*	7	6
CHCH	Green-tailed Towhee	*Chlorura chlorura*	7	6
PIER	Rufous-sided Towhee	*Pipilo erythrophthalmus*	7	6
PIFU	Brown Towhee	*Pipilo fuscus*	7	6?
PASA	Savannah Sparrow	*Passerculus sandwichensis*	7	4
AMSA	Grasshopper Sparrow	*Ammodramus savannarum*	7	4
CAMEL	Lark Bunting	*Calamospiza melanocorys*	7	4
POGR	Vesper Sparrow	*Pooecetes gramineus*	7	4
CHGR	Lark Sparrow	*Chondestes grammacus*	7	4
AMBI	Black-throated Sparrow	*Amphispiza bilineata*	4, 7	6
AMBE	Sage Sparrow	*Amphispiza belli*	4	6
JUAI	Dark-eyed Junco	*Junco hyemalis*	7	4
JUCA	Gray-headed Junco	*Junco caniceps*	7	4
AIRU	Rufous-crowned Sparrow	*Aimophila ruficeps*	4, 7	6
AICA	Cassin's Sparrow	*Aimophila cassinii*	4, 7	4
SPPA	Chipping Sparrow	*Spizella passerina*	7, 8, 9	6
SPPAL	Clay-colored Sparrow	*Spizella pallida*	7	4

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	BIRDS (Continued)			
SPBRE	Brewer's Sparrow	Spizella breweri	4, 7	6
ZOLE	White-crowned Sparrow	Zonotrichia leucophrys	7	6
CAOR	Chestnut-collared Longspur	Calcarius ornatus	7	4
	MAMMALS			
DIVI	Virginia Opossum	Didelphis virginiana	2	4
SOCI	Masked Shrew	Sorex cinereus	2	
SOME	Merriam's Shrew	Sorex merriami	2	14
SOVA	Vagrant Shrew	Sorex vagrans	2	14
SONA	Dwarf Shrew	Sorex nanus	2	
SOPA	Northern Water Shrew	Sorex palustris	2	
NOOR	Desert Shrew	Notiosorex crawfordi	2	
MYLU	Little Brown Myotis	Myotis lucifugus	2	13
MYYU	*Yuma Myotis	Myotis yumanensis	2	13
MYEV	Long-eared Myotis	Myotis evotis	2	13
MYTH	Fringed Myotis	Myotis thysanodes	2	13
MYCA	California Myotis	Myotis californicus	2	13
MYLE	Small-footed Myotis	Myotis leibii	2	13
MYAU	Southwestern Myotis	Myotis auriculus	2	
LANO	*Silver-haired Bat	Lasionycteris noctivagans	2	13
PIHE	*Western Pipistrel	Pipistrellus hesperus	2	3
FPFU	Big Brown Bat	Eptesicus fuscus	2	13
EUMA	*Spotted Bat	Euderma maculatum	2	3
PLTO	*Townsend's Big-eared Bat	Plecotus townsendii	2	4
ANPA	*Pallid Bat	Antrozous pallidus	2	4

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	MAMMALS (Continued)			
FAMA	Big Free-tailed Bat	Tadarida macrotis	2	?
TABR	Brazilian Free-tailed Bat	Tadarida brasiliensis	2	?
MAFL	Yellow-bellied Marmot	Marmota flaviventris	2	3
CYGU	*Gunnison's Prairie Dog	Cynomys gunnisoni	2	14
SPVA	Rock Squirrel	Spermophilus variegatus	2, 3	3
SPTR	Thirteen-lined Ground Squirrel	Spermophilus tridecemlineatus	2	14
SPSP	Spotted Ground Squirrel	Spermophilus spilosoma	2	14
SPLA	Golden-mantled Squirrel	Spermophilus lateralis	2	14
AMLE	White-tailed Antelope Squirrel	Ammospermophilus leucurus	2, 3	14
EUMI	Least Chipmunk	Eutamias minimus	2	14
EUDO	Cliff Chipmunk	Eutamias dorsalis	2	
EUQU	Colorado Chipmunk	Eutamias quadrivittatus	2	
THTA	Northern Pocket Gopher	Thomomys talpoides	2	14
THBO	Botta's Pocket Gopher	Thomomys bottae	2	14
PACA	Yellow-faced Pocket Gopher	Pappogeomys castanops	2	14
PEFLA	Plains Pocket Mouse	Perognathus flavescens	2	
PEFL	Silky Pocket Mouse	Perognathus flavus	2	
PEIN	Rock Pocket Mouse	Perognathus intermedius	2	
PEHI	Hispid Pocket Mouse	Perognathus hispidus	2	
DISP	Banner-tailed Kangaroo Rat	Dipodomys spectabilis	2, 3	14
DIOR	Ord's Kangaroo Rat	Dipodomys ordii	2, 3	14
DIME	Merriam's Kangaroo Rat	Dipodomys merriami	2	14
REMO	Plains Harvest Mouse	Reithrodontomys montanus	2	

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	MAMMALS (Continued)			
REME	Western Harvest Mouse	Reithrodontomys megalotis	2	15
PECR	Canyon Mouse	Peromyscus crinitus	2, 3	3
PEMA	Deer Mouse	Peromyscus maniculatus	2	14
PELE	White-footed Mouse	Peromyscus leucopus	2	14
PEBO	Brush Mouse	Peromyscus boylii	2	
PETR	Pinyon Mouse	Peromyscus truei	2, 3	4
PEDI	Rock Mouse	Peromyscus difficilus	2	
ONLE	Northern Grasshopper Mouse	Onychomys leucogaster	2, 3	14
ONTO	Southern Grasshopper Mouse	Onychomys torridus	2	14
NEMI	Southern Plains Mouse	Neotoma micropus	2	3
NEAL	White-throated Woodrat	Neotoma albigula	2	3
NEST	Stephen's Woodrat	Neotoma stephensi	2	3
NEME	Mexican Woodrat	Neotoma mexicana	2	3
NECI	Bushy-tailed Woodrat	Neotoma cinerea	2, 3	3
SIHI	Hispid Cotton Rat	Sigmodon hispidus	2	
SIFU	Tawny-bellied Cotton Rat	Sigmodon fulviventer	2	
MIPE	Meadow Vole	Microtus pennsylvanicus	2	14
MILO	Long-tailed Vole	Microtus longicaudus	2	14
MUMU	Norway Rat	Rattus norvegicus	2	14
MUMUS	House Mouse	Mus musculus		
ZAPR	Western Jumping Mouse	Zapus princeps	2	2
ERDO	Porcupine	Erethizon dorsatum	2, 3	5
LECA	*Black-tailed Jackrabbit	Lepus californicus	2	4
SYNU	*Nuttall's Cottontail	Sylvilagus nuttallii	2	14

Hypothetical List of Species (Continued)

Letter Code	Common Name	Scientific Name	Reference	Life Form
	MAMMALS (Continued)			
SYAU	*Audubon's Cottontail	Sylvilagus audubonii	2, 3	14
SYFL	*Eastern Cottontail	Sylvilagus floridanus	2	14
URAM	*Black Bear	Ursus americanus	2	14
BAAS	*Ringtail	Bassariscus astutas	2	3
MUFR	*Long-tailed Weasel	Mustela frenata	2	14
MUNIG	*Black-footed Ferret	Mustela nigripes	2	14
TATA	*Badger	Taxidea taxus	2, 3	14
SPGR	*Western Spotted Skunk	Spilogale gracilis	2	14
MEME	*Striped Skunk	Mephitis mephitus	2	14
COME	*Hog-nosed Skunk	Conepatus mesoleucus	2	14
CALA	*Coyote	Canis latrans	2	14
VUVU	*Red Fox	Vulpes vulpes	2	14
VUMA	*Kit Fox	Vulpes macrotis	2	14
URCI	*Gray Fox	Urocyon cinereoargenteus	2, 3	14
FECO	*Mountain Lion	Felis concolor	2	3
FERU	*Bobcat	Lynx rufus	2, 3	3
ODHE	*Mule Deer	Dama hemionus	1, 2	4
ANAM	*Pronghorn	Antilocapra americana	1, 2	4

*Significant species.

[1]References

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TASK 2 - SIGNIFICANT SPECIES LIST

This is a list of wildlife species which are expected to occur or have been verified within the study area that are considered significant by BLM. Significance was determined by using the 11 criteria shown below.

Terms and Symbols Used in the List

Criteria

1. Federal endangered (E) or threatened species (T)
2. State "endangered" or "threatened" species
3. Sensitive species
4. Designated priority management species, e.g., game species, protected species
5. Commercially valuable species (either legal or black market)
6. Quadrupeds harvested by hunting or trapping
7. Ungulates on crucial or important seasonal ranges
8. Species limited in number because of restricted habitat
9. Species limited in number because of position in the food chain
10. Animals of special interest for scientific study
11. Animals having a high viewing potential such as bison, eagles, etc.

Status

V - Verified within study area.
H - Presence within study area hypothetical.

Symbols

E - endangered
T - threatened
R - rare
U - unique
X - criteria applies
SU - status undetermined

LIST OF SIGNIFICANT SPECIES
CHACO STRIPPABLE COAL AREA

Letter Code	Species	Life Form	Status	Criteria 1	2	3	4	5	6	7	8	9	10	11	Reference
	REPTILES														
TEOR	Western Box Turtle	4	H										X		3, 7
PHDO	Desert Short-horned Lizard	4	V										X		11
CRCO	Collared Lizard	3	V											X	7
CNVE	Plateau Striped Whiptail	4	V										X		2
	BIRDS														
CAAU	Turkey Vulture	3	V				X					X	X	X	11
ACGE	Goshawk	10	V			R	X	X			X	X	X	X	8, 9, 11
ACCO	Cooper's Hawk	10	V			X	X	X				X	X		8, 9, 11
ACST	Sharp-shinned Hawk	10	V				X	X				X	X		8, 9, 11
CICY	Northern Harrier	4	V					X							9, 11
BULA	Rough-legged Hawk	4	V				X					X	X	X	9, 11, 20
BUREG	Ferruginous Hawk	3	V				X					X	X	X	9, 11, 14

LIST OF SIGNIFICANT SPECIES, CHACO STRIPPABLE COAL AREA - Continued

Letter Code	Species	Life Form	Status	Criteria 1	2	3	4	5	6	7	8	9	10	11	Reference
	BIRDS - Continued														
BUJA	Red-tailed Hawk	11	V				X	X				X	X	X	9, 11
BUSW	Swainson's Hawk	6	V				X					X	X	X	9, 11
AQCH	Golden Eagle	11	V				X					X	X	X	1, 9, 11, 13
FAME	Prairie Falcon	3	V			X	X	X			X	X	X		9, 11, 15
FACO	Merlin	10	V				X					X	X	X	9, 11, 18
FASP	American Kestrel	13	V				X	X			X	X	X	X	9, 11
CASQ	Scaled Quail	4	V			X	X	X					X		11
EUMO	Mountain Plover	4	V										X		9, 17
ZEMA	Mourning Dove	10	V					X	X				X		9, 11
OTAS	Screech Owl	13	H				X				X	X	X		11
BUVIR	Great Horned Owl	11	V				X					X	X	X	11
ASOT	Long-eared Owl	10	V				X					X	X		11
ASFL	Short-eared Owl	4	V				X					X	X		11
SPCU	Burrowing Owl	14	V				X				X	X	U		11

LIST OF SIGNIFICANT SPECIES, CHACO STRIPPABLE COAL AREA - Continued

Letter Code	Species	Life Form	Criteria												Reference
			Status	1	2	3	4	5	6	7	8	9	10	11	
	BIRDS - Continued														
OTFL	Flammulated Owl	13	V(?)[1]				X					X	X		11
LALU	Loggerhead Shrike	6	V										U		9, 11
VIHU	Hutton's Vireo	10	V										R		9, 10
PADO	House Sparrow	13	V										X		
	MAMMALS														
MYYU	Yuma Myotis	13	V										SU		5
LANO	Silver-haired Bat	13	V										SU		5
PIHE	Western Pipistrel	3	V										SU		5
EUMA	Spotted Bat	3	H										R		5, 16
PLTO	Townsend's Big-eared Bat	4	V										SU		5
ANPA	Pallid Bat	4	V										SU		5
CYGU	Gunnison's Prairie Dog	14	V				X						X		5
LECA	Black-tailed Jackrabbit	4	V						X						5, 11

LIST OF SIGNIFICANT SPECIES, CHACO STRIPPABLE COAL AREA - Continued

Letter Code	Species	Life Form	Status	Criteria 1	2	3	4	5	6	7	8	9	10	11	Reference
	MAMMALS - Continued														
SYNU	Nuttall's Cottontail	14	H						X						5, 11
SYAU	Audubon's Cottontail	14	V						X						5, 11
SYFL	Eastern Cottontail	14	H						X						5, 11
URAM	Black Bear	14	H				X		X						5, 11
BAAS	Ringtail	3	H				X	X	X						5, 11
MUFR	Long-tailed Weasel	14	H				X	X	X						5, 11
MUNIG	Black-footed Ferret	14	H	E	E	X	X				X	X	X		4, 5, 6, 10, 11
TATA	Badger	14	V					X	X						5, 11
SPGR	Western Spotted Skunk	14	H					X	X						5, 11
MEME	Striped Skunk	14	V					X	X						5, 11
COME	Hog-nosed Skunk	14	H					X	X						5, 11
CALA	Coyote	14	V					X	X						5
VUVU	Red Fox	14	V				X	X	X			X	X		5

LIST OF SIGNIFICANT SPECIES, CHACO STRIPPABLE COAL AREA - Continued

Letter Code	Species	Life Form	Status	Criteria 1	2	3	4	5	6	7	8	9	10	11	Reference
	MAMMALS - Continued														
VUMA	Kit Fox	14	V			R	X	X	X			X	X		5
URCI	Gray Fox	14	H				X	X	X			X	X		5
FECO	Mountain Lion	3	V				X	X	X			X	X		5, 11
FERU	Bobcat	3	V					X	X			X	X		5, 11
ODHE	Mule Deer	4	V				X	X	X				X		5, 11
ANAM	Pronghorn	4	V				X	X	X				X	X	5, 11

[1]Possible sighting but no positive identification.

References Used to Determine Significance

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TASK 3 - LIFE FORM ANALYSIS

Introduction

Thomas et al. (1979) points out that the large number of wildlife species present in most areas makes it difficult for the land manager to account for all of them in the land-use planning process. The life form analysis concept was, therefore, developed to reduce the vast amount of wildlife information on a given area to a concise, meaningful summary for management to understand and utilize in making the proper land use decisions. Briefly, the idea behind the life form concept is to place wildlife species into groups (life forms) based on specific combinations of habitat requirements for reproduction and feeding. Thus, literally hundreds of wildlife species can be reduced to 15 or 16 life forms. This enables the land manager to evaluate the response of wildlife to habitat much more readily than if each species were considered individually. A life form analysis was developed for the Chaco Coal study area for the significant species.

Analysis Matrices

Table 1 gives a description of the life forms used in the analysis. Table 2 is a list of species found during migration or accidental in the area. Table 3 shows the number of species using each standard habitat type for feeding and/or reproduction. Table 4 gives some key information concerning each species, including seasonal activity. Table 5

(Text continued on page 47)

Table 1. Life form descriptions.

Life form	Reproduces	Feeds	Examples
1	in water	on ground, in bushes and/or in trees	Tiger salamander Leopard frog
2	on ground around water	on ground, in bushes, trees, and water	Wandering garter snake
3	in cliffs, caves, rimrock, and/or talus	on ground or in air	Northern side-blotched lizard, Common raven, Bushytailed woodrat
4	on ground without specific water, cliff, rimrock or talus	on ground	Prairie rattlesnake, Scaled quail, Black-tailed jackrabbit
5	on ground	in bushes, trees, or the air	Townsend's solitaire, Porcupine
6	in bushes	on ground, in water, or in air	Sage thrasher, sage sparrow
7	in bushes	in trees, bushes, or the air	Bohemian waxwing
8	primarily in deciduous trees	in trees, bushes, or the air	Housefinch
9	primarily in conifers	in trees, bushes, or the air	Pinyon jay
10	in conifers or deciduous trees	in trees, in bushes, on ground, or in air	Western wood pewee, Goshawk

Table 1. Continued

Life form	Reproduces	Feeds	Examples
11	on very thick branches	on the ground or in water	Red-tailed hawk, Great horned owl
12	in own hole excavated in tree	in trees, in bushes, on ground, or in air	Common flicker, Hairy woodpecker
13	in a hole made by another species or natural hole	on ground, in water, or in air	American kestrel, Screech owl, Little brown myotis
14	in a burrow underground	on the ground or under it	Burrowing owl, White-tailed antelope ground squirrel
15	in a burrow underground	in air or in water	Roughwinged swallow

Table 2. Species found in the Chaco Strippable Coal Area during migration or "accidental" in the area.

Letter Code	Life Form	Common Name	Letter Code	Life Form	Common Name
POCA	2	Eared grebe	SERU	10	Rufous hummingbird
POPO	2	Pied-billed grebe	ASLE	12	Lewis' woodpecker
CHHY	2	Snow goose	MUFO	7	Scissor-tailed flycatcher
ANPL	2	Mallard	COSO	10	Western wood pewee
ANAC	2	Pintail	PAGA	13	Mountain chickadee
ANST	2	Gadwall	SICAR	12	White-breasted nuthatch
SPCL	2	Shoveler	TRAE	13	House wren
ANDI	2	Blue-winged teal	TUMI	6	American robin
ANCY	2	Cinnamon teal	POME	9	Black-tailed gnatcatcher
ANCA	2	Green-winged teal	RECA	9	Ruby-crowned kinglet
AYAM	2	Redhead	ANSP	4	Water pipit
AYAF	2	Lesser scaup	BOCE	8	Cedar waxwing
ACCO	10	Cooper's hawk	VIHU	10	Hutton's vireo
ACST	10	Sharp-shinned hawk	VEVI	5	Virginia's warbler
FACO	10	Merlin	DEPE	7	Yellow warbler
EGTH	2	Snowy egret	DECOAU	9	Yellow-rumped warbler
AROC	2	Great blue heron	OPTO	6	MacGillivray's warbler
PLCH	2	White-faced ibis	WIPU	4	Wilson's warbler
GRCA	2	Sandhill crane	XAXA	6	Yellow-headed blackbird
FUAM	3	American coot	AGPH	6	Red-winged blackbird
CHVO	2	Killdeer	ICPA	8	Scott's oriole
ACMA	2	Spotted sandpiper	ICGA	8	Northern oriole
CASE	2	Willet	PHLU	10	Rose-breasted grosbeak
ERMI	2	Least sandpiper	GUCA	7	Blue grosbeak
STTRI	2	Wilson's phalarope	SPPI	10	Pine siskin
CAGA	2	Common snipe	CAMEL	4	Lark bunting
CHNI	2	Black tern	SPARB	6	Tree sparrow
			CALAP	4	Lapland longspur

Table 3. The number of Significant Species using each standard habitat site for feeding and/or reproduction.

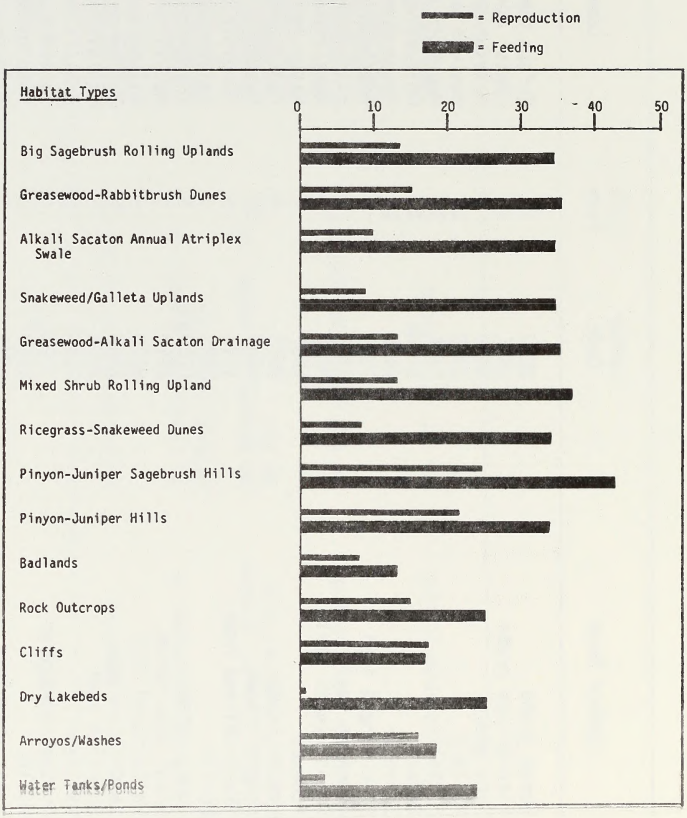


Table 4. Key information for significant species.

Reproductive Activity
Feeding Activity

Letter Code	Species	Life Form[1]	Activity: Seasonal Occurrence J F M A M J J A S O N D	Reproductive Capacity: potential per year (normal)	Home Range (h.r.) or Territory (terr.)
REPTILES					
TEOR	Western Box Turtle	4		2-8	
PHDO	Desert Short-horned Lizard	4		6-31	
CRCO	Collared Lizard	3		1-12	
CNVE	Plateau Striped Whiptail	4		3-5	
BIRDS					
CAAU	Turkey Vulture	3		1-3	
ACGE	Goshawk	10		3-5	Nesting terr. 6.4-9.7 km (4-6 mi) radius
ACCO	Cooper's Hawk	10		3-5	
ACST	Sharp-shinned Hawk	10		3-5	
CICY	Northern Harrier	4		4-6	
BULA	Rough-legged Hawk	4		2-6	
BURE	Ferruginous Hawk	3		3-8	
BUJA	Red-tailed Hawk	11		2-4	Nesting terr. 1.3-7.8 km^2 (0.5-3 mi^2)
BUSW	Swainson's Hawk	6		2-4	
AQCH	Golden Eagle	11		1-3	
FAME	Prairie Falcon	3		3-6	
FACO	Merlin	10		3-6	
FASP	American Kestrel	13		3-5	
CASQ	Scaled Quail	4			
EUMO	Mountain Plover	4		3	
ZEMA	Mourning Dove	10		2	

Table 4. Continued

Reproductive Activity
Feeding Activity

Letter Code	Species	Life Form[1]	Activity: Seasonal Occurrence J F M A M J J A S O N D	Reproductive Capacity: potential per year (normal)	Home Range (h.r.) or Territory (terr.)
BIRDS - Continued					
OTAS	Screech Owl	13		4-5	
BUVI	Great-horned Owl	11		2-3	Home range 1214 ha (3000 acres)
ASOT	Long-eared Owl	10		3-8	
ASFL	Short-eared Owl	4		4-9	
SPCU	Burrowing Owl	14		5-9	
OTFL	Flammulated Owl	13		2-4	Terr. 6.1-12.1 ha (15-30 acres)
LALU	Loggerhead Shrike	6		4-7	
VIHU	Hutton's Vireo	10		3-4	
PADO	House Sparrow	13		5-6	
MAMMALS					
MYYU	Yuma Myotis	13		1	
LANO	Silver-haired Bat	13		1-2	
PIHE	Western Pipistrel	3		1-2	
EUMA	Spotted Bat	3	Unknown	Unknown	Unknown
PLTO	Townsend's Big-eared Bat	4		1	
ANPA	Pallid Bat	4		1-3	
CYGU	Gunnison's Prairie Dog	14		3-5	
LECA	Black-tailed Jackrabbit	4		6-8	
SYNU	Nuttall's Cottontail	14		6-12	
SYAU	Audubon's Cottontail	14		6-12	1-15 acres

Table 4. Continued

Reproductive Activity
Feeding Activity

Letter Code	Species	Life Form[1]	Activity: Seasonal Occurrence J F M A M J J A S O N D	Reproductive Capacity: potential per year (normal)	Home Range (h.r.) or Territory (terr.)
MAMMALS - Continued					
SYFL	Eastern Cottontail	14		12-30	3-20 acres
URAM	Black Bear	14		2-3	1000-2500 acres
BAAS	Ringtail	3		3-4	
MUFR	Long-tailed Weasel	14			
MUNIG	Black-footed Ferret	14	Unknown	Unknown	Unknown
TATA	Badger	14		2-5	
SPGR	Western Spotted Skunk	14		1-5	640 acres
MEME	Striped Skunk	14		6-7	40-100 acres
COME	Hog-nosed Skunk	14		2-4	
CALA	Coyote	14		5-10	h.r. 10-100 mi.
VUVU	Red Fox	14		4-9	h.r. 1-2 sq. mi.
VUMA	Kit Fox	14		4-7	
URCI	Gray Fox	14		3-4	
FECO	Mountain Lion	3		1-6 (2)	h.r. 75-100 mi.
FERU	Bobcat	3		3-4	1300 acres
ODHE	Mule Deer	4		1-3 (2)	h.r. 90-600+ acres
ANAM	Pronghorn	4		1-3 (2)	h.r. 2-4 mi.

[1]Refer to Table 2 for life form descriptions.

Table 5. Orientation of species to standard habitat sites and special habitat features for feeding and reproduction, Chaco Strippable Coal Wildlife Study Area, New Mexico.

LIFE FORM 3 - Reproduces in cliffs, caves, rimrock and/or talus
Feeds on the ground or in the air
9 species

F - Feeding
R - Reproduction
X - Feeding and Reproduction

Letter Code	Name	Habitat Sites										Special Features					
		Alkali Sacaton/Annual Atriplex Swale	Ricegrass/Snakeweed Dunes	Snakeweed/Galleta Uplands	Greasewood/Alkali Sacaton Drainage	Greasewood/Rabbitbrush Dunes	Mixed Shrub Rolling Uplands	Sagebrush/Galleta Rolling Uplands	Pinyon-Juniper/Sagebrush Hills	Pinyon-Juniper Hills	Badlands	Rock Outcrops	Cliffs	Dry Lake Beds	Arroyos/Washes	Water Tanks/Ponds	
REPTILES																	
CRCO	Collared lizard								X	X		X	X				
BIRDS																	
CAAU	Turkey vulture	F	F	F	F	F	F	F	F	F	X	F	X	F	F	F	
BUREG	Ferruginous hawk	F	F	F	F	F	F	F	X	X	X	X	R	F	X	F	
FAME	Prairie Falcon	F	F	F	F	F	F	F	F	F	X	F	X	F	F	F	Hypothetical
MAMMALS																	
PIHE	Western Pipistrel				F	F			X	X		X	X	F	X	F	
EUMA	Spotted bat				F	F		F	X	X			X		F	F	
BAAS	Ringtail	F	F	F	F	F	F	F	F	F		X			X	X	
FECO	Mountain lion	F	F	F	F	F	F	F	F	F	X	X	X	F	X	F	
FERU	Bobcat	F	F	F	F	X	F	F	F	X	X	X	X	F	F	F	

Table 5. Continued

LIFE FORM 4 - Reproduces on ground without specific water, cliff, rimrock or talus
Feeds on the ground
13 species

F - Feeding Only
R - Reproducing Only
X - Reproducing and Feeding

Letter Code	Name	Habitat Sites										Special Features					
		Alkali Sacaton/Annual Atriplex Swale	Ricegrass/Snakeweed Dunes	Snakeweed/Galleta Uplands	Greasewood/Alkali Sacaton Drainage	Greasewood/Rabbitbrush Dunes	Mixed Shrub Rolling Uplands	Sagebrush/Galleta Rolling Uplands	Pinyon-Juniper/Sagebrush Hills	Pinyon-Juniper Hills	Badlands	Rock Outcrops	Cliffs	Dry Lake Beds	Arroyos/Washes	Water Tanks/Ponds	
REPTILES																	
TEOR	Western box turtle	X	X	X	X	X	X	X	X								Hypothetical
PHDO	Desert Short-horned lizard	X	X	X	X	X	X	X	X			X					
CNVE	Plateau striped whiptail						X		X			X					
BIRDS																	
CICY	Northern harrier	F	F	F	F	F	F	F						F	F	F	Winter Resident
BULA	Rough-legged hawk	F	F	F	F	F	F	F			F	F					Migrant and/or winter visitor
CASQ	Scaled quail	F	F	X	X	X	X	X	F						F		
EUMO	Mountain plover	X	F	F	F		F							X		F	
ASFL	Short-eared owl	F	F	F	F	F	F	F							F		Winter visitor
MAMMALS																	
PLTO	Townsend's big-eared bat							F	X	X		F	X	F	X	F	
ANPA	Pallid bat							F	X	X		F	X	F	X	F	
LECA	Black-tailed jackrabbit	F	F	F	F	F	F	X	X								
ODHE	Mule deer								X	X							
ANAM	Pronghorn	F	F	F	F	F	F	X	F								

Table 5. Continued

LIFE FORM 6 - Reproduces in bushes
Feeds on the ground
2 species

F - Feeding
R - Reproducing only
X - Feeding and Reproducing

Letter Code	Name	Habitat Sites: Alkali Sacaton/Annual Atriplex Swale	Ricegrass/Snakeweed Dunes	Snakeweed/Galleta Uplands	Greasewood/Alkali Sacaton Drainage	Greasewood/Rabbitbrush Dunes	Mixed Shrub Rolling Uplands	Sagebrush/Galleta Rolling Uplands	Pinyon-Juniper/Sagebrush Hills	Pinyon-Juniper Hills	Badlands	Special Features: Rock Outcrops	Cliffs	Dry Lake Beds	Arroyos/Washes	Water Tanks/Ponds
BIRDS																
BUSW	Swainson's hawk	F	F	F	F	F	F	F	X	X	F	F		F	X	
LALU	Loggerhead shrike	F	F	F	X	X	X	X	X			F		F	F	

LIFE FORM 10 - Reproduces primarily in conifers
Feeds in trees, bushes, or in the air
7 species

F - Feeding
R - Reproducing only
X - Feeding and Reproducing

Letter Code	Name	Habitat Sites: Alkali Sacaton/Annual Atriplex Swale	Ricegrass/Snakeweed Dunes	Snakeweed/Galleta Uplands	Greasewood/Alkali Sacaton Drainage	Greasewood/Rabbitbrush Dunes	Mixed Shrub Rolling Uplands	Sagebrush/Galleta Rolling Uplands	Pinyon-Juniper/Sagebrush Hills	Pinyon-Juniper Hills	Badlands	Special Features: Rock Outcrops	Cliffs	Dry Lake Beds	Arroyos/Washes	Water Tanks/Ponds	
BIRDS																	
ACGE	Goshawk								F	F			F			F	Rare winter visitor
ACCO	Cooper's Hawk				F	F		F	F	F							Unusual migrant
ACST	Sharp-shinned hawk	F	F	F	F	F	F	F	F	F						F	Unusual migrant
FACO	Merlin	F	F	F	F	F	F	F						F		F	Unusual migrant
ZEMA	Mourning Dove	F	F	F	X	X	F	X	X	X				F	R	R	
ASOT	Long-eared owl								X	X			X	F		F	
VIHU	Hutton's vireo								X	X							Rare

Table 5. Continued

LIFE FORM 11 - Reproduces on very thick branches
Feeds on the ground or in the water
3 species

F - Feeding
R - Reproducing only
X - Feeding and Reproducing

Letter Code	Name	Habitat Sites: Alkali Sacaton/Annual Atriplex Swale	Ricegrass/Snakeweed Dunes	Snakeweed/Galleta Uplands	Greasewood/Alkali Sacaton Drainage	Greasewood/Rabbitbrush Dunes	Mixed Shrub Rolling Uplands	Sagebrush/Galleta Rolling Uplands	Pinyon-Juniper/Sagebrush Hills	Pinyon-Juniper Hills	Badlands	Special Features: Rock Outcrops	Cliffs	Dry Lake Beds	Arroyos/Washes	Water Tanks/Ponds
BIRDS																
BUJA	Red-tailed hawk	F	F	F	F	F	F	F	X	X	F	F	R	F	R	F
AQCH	Golden eagle	F	F	F	F	F	F	F	F	F	X	F	X	F	F	F
BUVIR	Great horned owl	F	F	F	F	F	F	F	X	X	F	F	X	F	R	F

LIFE FORM 13 - Reproduces in a hole made by another species or in a natural hole
Feeds on the ground, in water, or the air
6 species

F - Feeding
R - Reproducing only
X - Feeding and Reproducing

Letter Code	Name	Habitat Sites: Alkali Sacaton/Annual Atriplex Swale	Ricegrass/Snakeweed Dunes	Snakeweed/Galleta Uplands	Greasewood/Alkali Sacaton Drainage	Greasewood/Rabbitbrush Dunes	Mixed Shrub Rolling Uplands	Sagebrush/Galleta Rolling Uplands	Pinyon-Juniper/Sagebrush Hills	Pinyon-Juniper Hills	Badlands	Special Features: Rock Outcrops	Cliffs	Dry Lake Beds	Arroyos/Washes	Water Tanks/Ponds	
BIRDS																	
FASP	American kestrel	F	F	F	F	F	F	F	X	X	X	F	R	F	R		
OTAS	Screech owl													F	X	F	Rare resident
OTFL	Flammulated owl								F	F							Rare resident
PADO	House Sparrow	X	X	X	X	X	X	X	X	X						X	resident
MAMMALS																	
MYYU	Yuma Myotis								F	F		X	X	F	X	F	
LANO	Silver-haired bat								F	F		X	X	F	X	F	Migratory

Table 5. Continued

LIFE FORM 14 - Reproduces in a burrow underground
Feeds on the ground or under it
16 species

F - Feeding
R - Reproducing only
X - Feeding and Reproducing

Letter Code	Name	Habitat Sites: Alkali Sacaton/Annual Atriplex Swale	Ricegrass/Snakeweed Dunes	Snakeweed/Galleta Uplands	Greasewood/Alkali Sacaton Drainage	Greasewood/Rabbitbrush Dunes	Mixed Shrub Rolling Uplands	Sagebrush/Galleta Rolling Uplands	Pinyon-Juniper/Sagebrush Hills	Pinyon-Juniper Hills	Badlands	Special Features: Rock Outcrops	Cliffs	Dry Lake Beds	Arroyos/Washes	Water Tanks/Ponds	
BIRDS																	
SPCU	Burrowing owl	X	X	X			X										
MAMMALS																	
CYGU	Gunnison's prairie dog	X	X	X			X										
SYNU	Nuttall's cottontail	F	F	F	X	X	X	X	X								
SYAU	Audubon's cottontail	F	F	F	X	X	X	X	X								
SYFL	Eastern cottontail	F	F	F	X	X	X	X	X								
URAM	Black bear								X	X							Hypothetical
MUFR	Long-tailed weasel								X	X		X				X	Probably more widely distributed than noted
MUNIG	Black-footed ferret	X	X	X			X										Hypothetical
TATA	Badger	X	X	X	F	F	X	F	F					F			
SPGR	Western spotted skunk				X	X	F		X	X		X					
MEME	Striped skunk	F	F	F	X	X	F							F	X	X	
COME	Hognose skunk				X	X	F		X	X		X					Hypothetical
CALA	Coyote	F	F	F	X	X	F	X	X	X	X	X	X	F	X	F	
VUVU	Red fox	F	F	F	F	F	F	F	F	F							Uncommon to Rare
VUMA	Kit fox	X	X	X	X	X	X	X									
URCI	Gray fox								X	X		X					

gives the orientation of wildlife species to each standard habitat type and certain special habitat features. Table 6 displays some selected references used for each species.

Table 6. Selected references for significant species.

Letter Code	Life Form	Significant Species	Selected References
REPTILES			
TEOR	4	Western Box Turtle	Degenhardt and Christiansen 1974; Dean and Stock 1961; Jones 1970; Stebbins 1966; Behler and King 1979.
PHDO	4	Desert short-horned lizard	Dean and Stock 1961; Douglas 1966; Gelbach 1965; Jones 1970; Smith 1946; Stebbins 1966; Harris 1963; Goldberg 1971; Pianka and Parker 1975; Reeve 1952.
CRCO	3	Collared lizard	Dean and Stock 1961; Douglas 1966; Gelbach 1965; Jones 1970; Smith 1946; Stebbins 1966; Harris 1963.
CNVE	4	Plateau striped whiptail	Apslund 1974; Dean and Stock 1961; Douglas 1966; Gelbach 1965; Jones 1970; Smith 1946; Stebbins 1966; Harris 1963.
BIRDS			
CAAU	3	Turkey vulture	Ligon 1961; Hubbard 1978; Bent 1961; Coles 1938; Kempton 1927.
AGGE	10	Goshawk	Ligon 1961; Jackman and Scott 1975; McGowan 1975; Reynolds 1975; Jones 1979.
ACCO	10	Cooper's hawk	Ligon 1961; Henny 1972; Meng 1952; Reynolds 1975; Jones 1979.
ACST	10	Sharp-shinned hawk	Ligon 1961; Brown 1973; Jackman and Scott 1975; Reynolds 1975; Jones 1979.
CICY	4	Northern harrier	Ligon 1961; Clark and Ward 1974; Craighead and Craighead 1969; Urner 1925.
BULA	4	Rough-legged hawk	Ligon 1961; Brown and Amadon 1968; Schnell 1968; Springer 1975; Zarn 1975.

Table 6. Continued

Letter Code	Life Form	Significant Species	Selected References
BIRDS - Continued			
BURE	3	Ferruginous hawk	Ligon 1961; Snow 1974a; Wakeley 1974; Weston 1969.
BUJA	11	Red-tailed hawk	Ligon 1961; Fitch et al. 1946; Gates 1972; Luttich et al. 1970.
BUSW	6	Swainson's hawk	Ligon 1961; Browning 1974; Craighead and Craighead 1969; Olendorff 1972.
AQCH	11	Golden eagle	Ligon 1961; Baglien 1975; Oldendorff 1976; Snow 1973.
FAME	3	Prairie falcon	Ligon 1961; Denton 1976; Marti and Braun 1975; Snow 1974b.
FACO	10	Merlin	Ligon 1961; Fox 1971; Johnson and Coble 1967; Trimble 1975.
FASP	13	American kestrel	Ligon 1961; Balda 1975; Enderson 1960; Henny 1972; McClelland and Frissell 1975; McLaren 1962; Roest 1957; Smith et al. 1972.
CASQ	4	Scaled quail	Ligon 1961; Sawyer 1973; Wallmo 1956; Banks 1970; Schemnitz 1961; Snyder 1965; Goodwin and Hungerford 1977; Borden 1973; Russell 1932.
EUMO	4	Mountain plover	Ligon 1961; Tolle 1976.
ZEMA	10	Mourning dove	Ligon 1961; Aldrich and Duvall 1958; U.S. Department of the Interior, Fish and wildlife Service 1962.
OTAS	13	Screech owl	Ligon 1961; Jackman 1974; Nowicki 1974; VanCamp and Henny 1975.
BUVI	11	Great-horned owl	Ligon 1961; Baumgartner 1939; Henry 1972; Rusch et al. 1972.
ASOT	10	Long-eared owl	Ligon 1961; Armstrong 1958; Maser et al. 1970; Reynolds 1970.

Table 6. Continued

Letter Code	Life Form	Significant Species	Selected References
BIRDS - Continued			
ASFL	4	Short-eared owl	Ligon 1961; Banfield 1947; Clark 1975; Marti 1974.
SPCU	14	Burrowing owl	Ligon 1961; Coulombe 1971; Maser et al. 1971; Zarn 1974.
OTFL	13	Flammulated owl	Ligon 1961; Balda 1975; Balda et al. 1975; Bull and Anderson 1978; Jackman 1974; Marshall 1939; Winter 1974.
LALU	6	Loggerhead shrike	Ligon 1961; Porter et al. 1975; Smith 1973a, 1973b.
VIHU	10	Hutton's vireo	Ligon 1961; Chapin 1925.
PADO	13	House sparrow	Ligon 1961; Jackman 1974; Kendeigh 1973.
MAMMALS			
MYYU	13	Yuma myotis	Bailey 1936; Barbour and Davis 1969; Dalquest 1947a.
LANO	13	Silver-haired bat	Bailey 1936; Barbour and Davis 1969; Harris 1963; Saul et al. 1977; Whitaker et al. 1977; Findley et al. 1975.
PIHE	3	Western pipistrel	Barbour and Davis 1969; Bradley and O'Farrell 1969; Cross 1965.
EUMA	3	Spotted bat	Barbour and Davis 1969; Easterla 1971; Snow 1974c; Findley and Jones 1965; Findley et al. 1975; Constantine 1961; Handley 1959.
PLTO	4	Townsend's big-eared bat	Dalquest 1947b; Humphrey and Kunz 1976.
ANPA	4	Pallid bat	Barbour and Davis 1969; Beck and Rudd 1960; Orr 1954.

Table 6. Continued

Letter Code	Life Form	Significant Species	Selected References
MAMMALS - Continued			
CYGU	14	Gunnison's prairie dog	Findley et al. 1975; Lechleitner 1969; Bailey 1932; Harris 1963.
LECA	4	Black-tailed jackrabbit	Hansen 1972; Haskell and Reynolds 1947; Sparks 1968.
SYNU	14	Nuttall's cottontail	Bailey 1936; Orr 1940; Powers and Verts 1971.
SYAU	14	Audubon's cottontail	Findley et al. 1975; Orr 1940; Hinds 1973.
SYFL	14	Eastern cottontail	Findley et al. 1975; Chapman and Tretheway 1972; Lord 1963.
URAM	14	Black bear	Findley et al. 1975; Jonkel 1979; Jonkel and Cowen 1971; Kemp 1972.
BAAS	3	Ringtail	Findley et al. 1975.
MUFR	14	Long-tailed Weasel	Bailey 1936; Hall 1951; Heidt et al. 1976; Ingles 1939; Findley et al. 1975; Harris 1963.
MUNIG	14	Black-footed ferret	Findley et al. 1975; Berghofer 1967b; Snow 1972.
TATA	14	Badger	Findley et al. 1975; Lindzey 1976; Sargeant and Warner 1972; Snead and Hendrickson 1942; Harris 1963.
SPGR	14	Western spotted skunk	Bailey 1936; Baker and Baker 1975; Crabb 1948; Patton 1974; Findley et al. 1975; Harris 1963.
MEME	14	Striped skunk	Bailey 1971; Shump et al. 1975; Verts 1967; Findley et al. 1975; Harris 1963.

Table 6. Continued

Letter Code	Life Form	Significant Species	Selected References
MAMMALS - Continued			
COME	14	Hog-nosed skunk	Findley et al. 1975; Barber 1902.
CALA	14	Coyote	Gier 1968; Knowlton 1972; Mathwig 1973; Murie 1940; Findley et al. 1975; Roughton 1979; Harris 1963.
VUVU	14	Red fox	Sheldon 1949; Stanley 1963; Storm et al. 1976; Findley et al. 1975; Roughton 1979; Harris 1963.
VUMA	14	Kit fox	Findley et al. 1975; Packard and Bowers 1970; Rohwer and Kilgore 1973; Harris 1963.
URCI	14	Gray fox	Bailey 1936; Sullivan 1956; Wood 1958; Findley et al. 1975; Roughton 1979; Harris 1963.
FECO	3	Mountain lion	Findley et al. 1975; Bailey 1932; Berghofer 1967a; Clothier 1957
FERU	3	Bobcat	Crowe 1975; Gashwiler et al. 1961; Berghofer 1967a; Findley et al. 1975; Harris 1963.
ODHE	4	Mule deer	Julander et al. 1961; Terrel 1973; Findley et al. 1975; Steward 1967; Bailey 1932; Leopold 1959.
ANAM	4	Pronghorn	Autenrieth and Fichter 1975; Sundstrom et al. 1973; Yoakum 1967; Findley et al. 1975; Larsen 1967.

TASK 4 - SPECIAL HABITAT FEATURES INVENTORY

Certain habitats are limited in quantity and may be "unique" in that they attract vertebrate species that might not otherwise occupy the desert-shrub ecosystem of northwestern New Mexico and support more resident species at higher densities. These "special habitat features" may be either natural or manmade. Each field crew had the responsiblity of recording special habitat features on ADO Forms 6602-1, Special Habitat Features, and 6602-2, Special Habitat Feature/Water-Related.

Water Related Special Habitat Features

A total of 22 water related special features were recorded. A summary is presented below.

Manmade	Number Recorded
Stockwater ponds	15
Windmills	3
Water trough	1
Sewage pond	1
Reservoir	1
Natural	
Temporary pond	1

Many species of migrating waterfowl and shorebirds were observed in and around the water-related special features. Tanner Lake (south) is exceptional in its attractiveness to waterfowl and shorebirds in the early spring. Probably its relatively large size in the region and

cover provided by the tamarisk add to its desirability as a rest stop during migration. The pond is usually completely dry by late spring and is of little value during the rest of the year. Table 7 presents a summary of wildlife utilization of special habitat features that was noted while documenting the feature on the appropriate form.

Non-Water Related Special Habitat Features

Non-water related special features are summarized below.

Manmade	Number Recorded
Bridge	1
Oil well	1
Natural	
Cliff	11

Some of the cliff areas were sampled with small mammal traplines, the results of which are included in the mammals section of the Animal Occurrence Survey. The results of the raptor nest inventory of the cliff areas are summarized in the avian section. See Table 7 for the species utilization of non-water related features.

Table 7. Species observed using special habitat features, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Code	Species	Dry Lake Beds	Stock Water Tank	Creeks	Temporary Ponds	Manmade Stock Ponds	Permanent Ponds	Windmills	Reservoirs	Cliffs	Pumping Station	Intermittent Lakes
BIRDS												
POCA	Eared Grebe											MI
POPO	Pied-billed Grebe		SU[1]									
ANPL	Common Mallard					FW						MI
ANAC	Pintail		SU						SP MI			
SPCL	Northern Shoveler		SU						SP MI			MI
ANSTR	Gadwall					FW						
ANDIS	Blue-winged Teal		SU						SP MI			MI
ANCA	Green-winged Teal											MI
ACGE	Goshawk	FW										
BUJA	Red-tailed Hawk									YL		
BUSW	Swainson's Hawk				SS WI							
AQCH	Golden Eagle		SS							YL		
FASP	American Kestrel									YL		
FAME	Prairie Falcon	FW								YL		
CASQ	Scaled Quail	FW				YL						
EGTH	Snowy Egret											MI
ARHE	Great Blue Heron											MI
FUAM	American Coot		SS									MI
CHVO	Killdeer		SS									
ACMA	Spotted Sandpiper			SS								
CASE	Willet		SU									MI
ERMI	Least Sandpiper			SS					SP MI			
SITRI	Wilson's Phalarope								SP MI			MI
ZEMA	Mourning Dove			YL						SS		
BUVIR	Great-horned Owl	FW								YL		
ASOT	Long-eared Owl	FW								YL		
ASFL	Short-eared Owl					YL						
OTFL	Flammulated Owl									SS		
COAU	Common Flicker	FW										
MUFO	Scissor-tailed Flycatcher		SS									
TYVE	Western Kingbird											
TYVO	Cassin's Kingbird									SS		
MYCI	Ash-throated Flycatcher									SS		
SASA	Say's Phoebe									SS		
ERAL	Horned Lark		FW			FW				FW	SS	
HIRU	Barn Swallow			SS								
PEPY	Cliff Swallow			SS								
TATH	Violet-green Swallow			SS								
GYCY	Pinyon Jay									SP SU		
COCO	Common Raven	FW								YL		
PAIN	Plain Titmouse									YL		
THBE	Bewick's Wren	FW								SP SU		
SAOB	Rock Wren									YL		
TOBE	Bendire's Thrasher					SS						

Table 7. Continued

Code	Species	Dry Lake Beds	Stock Water Tank	Creeks	Temporary Ponds	Manmade Stock Ponds	Permanent Ponds	Windmills	Reservoirs	Cliffs	Pumping Station	Intermittent Lakes
BIRDS - Continued												
ORMO	Sage Thrasher			YL								
ANSP	Water Pipit			SS								
LALU	Loggerhead Shrike					YL				YL		
STNE	Western Meadowlark		SS									
XAXA	Yellow-headed Blackbird											
AGPH	Red-winged Blackbird			SS								
EUCY	Brewer's Blackbird											
MOAT	Brown-headed Cowbird										SS	
ICBA	Northern Oriole									SS		
CAMEX	House Finch					FW						
PIFU	Brown Towhee					FW						
PIER	Rufous-sided Towhee									SS		
AMBE	Sage Sparrow	FW				FW				YL		
JUHY	Dark-eyed Junco											
AMBI	Black-throated Sparrow									SS		
CALA	Lapland Longspur	FW										
MAMMALS												
	Bats									SP		
LECA	Black-tailed Jackrabbit	FW										
SYAU	Desert Cottontail	FW										
NECI	Bushy-tailed Woodrat									YL		
REPTILES												
	Lizards			YL						YL		

[1]SP - Spring; SU - Summer; FA - Fall; WI - Winter; SS - Spring/Summer; SF - Summer/Fall; FW - Fall/Winter; WS - Winter/Spring; YL - Year-Long; MI - Migratory.

TASK 5 - ANIMAL OCCURRENCE SURVEY

Introduction

A Level III animal species occurrence survey was completed for reptiles, amphibians, mammals, and birds. As defined by BLM, a Level III inventory is four or more samples within a standard habitat site during all four seasons.

Because a vast amount of data were collected over the course of the study, a separate and independent section was prepared for each major vertebrate group.

Relative abundance of all species except amphibians, reptiles, and certain rodents was determined by applying the following categories developed by the Wyoming Game and Fish Department (1977):

Verbal Designation	Definition
RARE	A species that occupies only a small percentage of the preferred habitat within its range or a species that is found throughout its range in extremely low densities; cannot always be found by a skilled observer even during intensive survey work.
UNCOMMON	A species that is common only in small areas within its range or a species that is found throughout its range in relatively low densities; usually requires intensive searching to be seen by a skilled observer.
COMMON	A species that inhabits much of the preferred habitat within its range; the species or its sign can usually be seen on any outing by a skilled observer during the proper season.
ABUNDANT	A species that inhabits much of the preferred habitat within its range; the species or its sign can be seen in numbers on any outing by a skilled observer during the proper season.

Verbal Designation	Definition
PERIPHERAL	A species whose range extends only into a small portion of New Mexico.
UNDETERMINED	A species whose existence within the state is verified but not adequately documented. Data regarding population density or distribution are inadequate for assignment to one of the above categories.

The category definitions were found to be very practical in that they consider species range variation, density level, and degree of observability.

MAMMAL SURVEY

Introduction

The mammalian fauna inhabiting the study area constitute a relatively diverse group. The taxa of the Chaco Strippable Coal region consist of 35 species, 27 genera, and 11 families of 5 orders. Certain of these taxa are restricted by biological requirements to small pockets of habitat, while others are found throughout the area. A sampling program to assess the status of mammals required a broad, but systematic approach. A survey, conducted on a seasonal basis, was carried out from November 1980 to August 1981 to compile, analyze, and evaluate baseline data concerning mammal populations on the study area. The mammal survey field effort was consistently directed toward completing key elements of the overall study, i.e., a species inventory, spatial and temporal distribution, and relative abundance.

Literature Review

A majority of the available literature in the study area is in the form of unpublished reports by energy companies or environmental impact statements. The most specific reports were those prepared by the Sunbelt Mining Company, Inc. (1980, 1981). Most of the other reports were quite general and not pertinent to the study area. In the interest of brevity, citations of all literature used are not presented here but included in the appropriate sections.

Methods

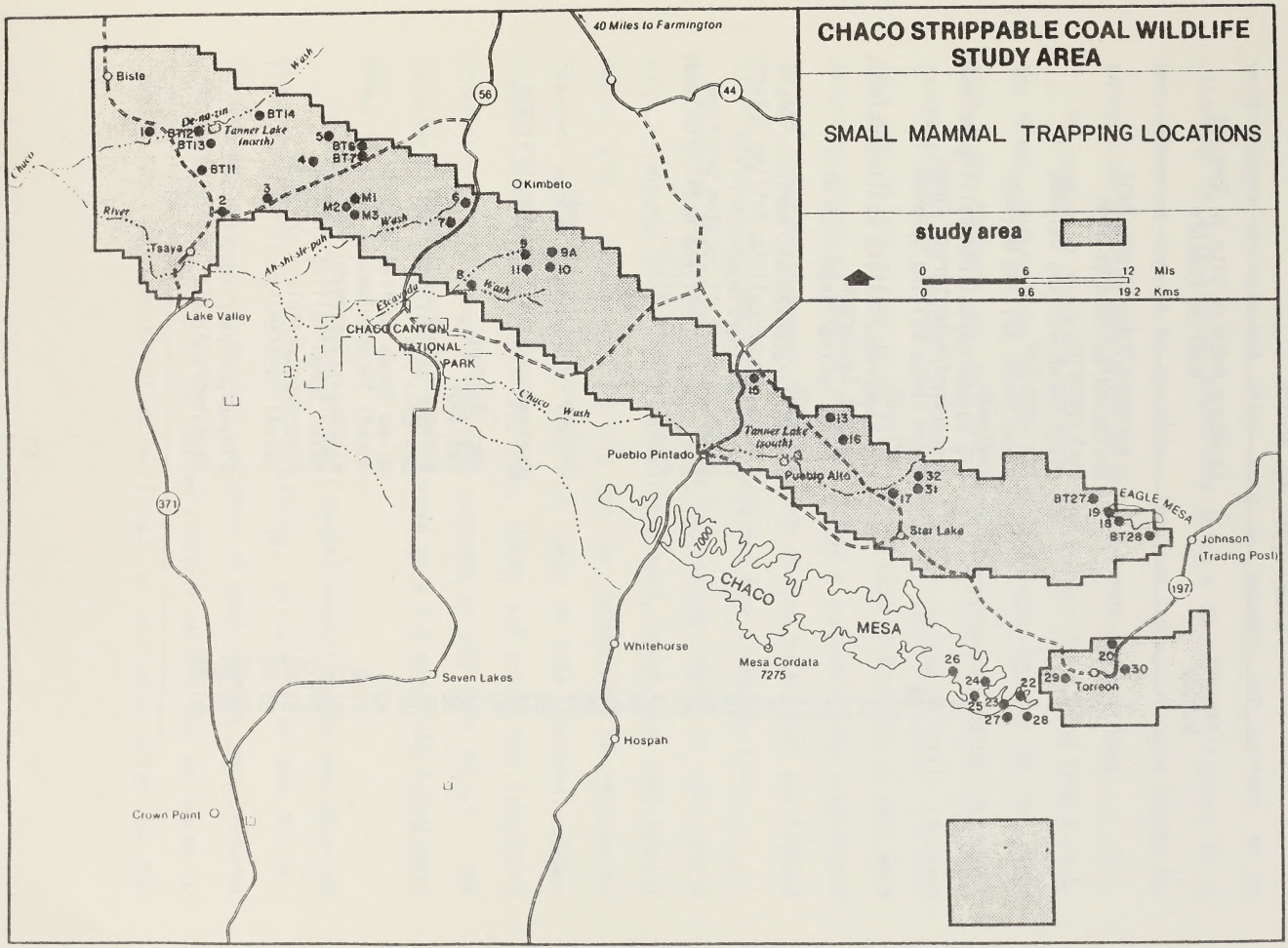
The primary methods used for collecting mammal data were small mammal trapping, driving surveys, aerial surveys, and scent post stations. Several additional methods were used for bats and will be discussed individually. Much of the lagomorph data was obtained from the avian surveys through recording of flushed individuals.

Small Mammal Trapping

Both live and snap trapping were conducted at each of the 40 sample sites. Figure 3 shows the general location of each small mammal trapping transect. Table 8 shows the transect number and the standard habitat site in which it was located. Maps showing locations are provided in Appendix E. The types of traps used included 2½ x 2½ x 9 in. Sherman live traps, Museum Special snap traps, Victor rat traps, Macabee gopher traps, and pit traps.

Twenty-five Sherman live traps were baited with a mixture of peanut butter and rolled oats and placed in a 5 by 5 trap grid (60 x 60 m) with a 15 meter spacing. During the colder seasons, several cotton balls were placed in each trap to provide nesting material and insulation. When possible, traps were placed under bushes or other overhead protection or partially buried in soil.

A line of 25 snap traps consisting of 20 Museum Specials and 5 rat traps, placed 5 meters apart and baited with peanut butter and oats, was also established at each sample site. In most cases, the snap traps


CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
SMALL MAMMAL TRAPPING LOCATIONS
study area
0 6 12 Mls
0 9.6 19.2 Kms
40 Miles to Farmington
Biste
Tsaya
Lake Valley
Kimbeto
CHACO CANYON NATIONAL PARK
Pueblo Pintado
Pueblo Alto
Star Lake
EAGLE MESA
Johnson (Trading Post)
Torreon
CHACO MESA
Mesa Cordata 7275
Whitehorse
Hospah
Seven Lakes
Crown Point
Tanner Lake (north)
Tanner Lake (south)
Chaco River
Chaco Wash
Escavada Wash
Ah-shi-sle-pah Wash
De-na-zin Wash
56
44
371
197
1000
BT11
BT12
BT13
BT14
BT6
BT7
BT27
BT28
M1
M2
M3
9A
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11
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15
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31
32

Figure 3

Table 8. Small mammal trapping transects and the standard habitat site or special habitat feature in which they were located, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Transect Number	Standard Habitat Site or Special Habitat Feature
1	Greasewood/Rabbitbrush Dune
2	Snakeweed/Galleta Uplands
3	Rock Outcrop
4	Mixed Shrub Rolling Uplands
5	Dry Lake Bed
6	Mixed Shrub Rolling Uplands
7	Badlands
8	Big Sagebrush/Galleta Rolling Uplands
9	Greasewood/Rabbitbrush Dunes
9A	Mixed Shrub Rolling Uplands
10	Badlands
11	Big Sagebrush/Galleta Rolling Uplands
13	Treated Sagebrush
15	Pinyon-Juniper/Sagebrush Hills
16	Badlands
17	Alkali Sacaton/Annual Atriplex Swale
18	Big Sagebrush/Galleta Rolling Uplands
19	Pinyon-Juniper/Sagebrush Hills
20	Greasewood/Alkali Sacaton Drainage
22	Big Sagebrush/Galleta Rolling Uplands
23	Pinyon-Juniper Hills
24	"
25	"
26	"
27	Snakeweed/Galleta Uplands
28	"
29	Greasewood/Alkali Sacaton Drainage
30	"
31	Rock Outcrop
32	Badlands
M1	Ricegrass/Snakeweed Dunes
M2	Dry Lake Bed
M3	Mixed Shrub Rolling Uplands
BT-6	Alkali Sacaton/Annual Atriplex Swale
BT-7	Ricegrass/Snakeweed Dunes
BT-11	Mixed Shrub Rolling Uplands
BT-12	Greasewood/Rabbitbrush Dunes
BT-13	Alkali Sacaton/Annual Atriplex Swale
BT-14	"
BT-27	Pinyon-Juniper/Sagebrush Hills
BT-28	Greasewood/Alkali Sacaton Drainage

were placed at selected sites such as runways and burrows as we attempted to directly "go after" the animals to insure a capture of as many different species as possible. The snap trap lines were placed far enough from the live trap grids to avoid movement between them.

The number of trapping transects within each SHS varied from 2 to 5. The mixed shrub/rolling upland had 5 transects because of its large size. One transect was left out of the greasewood/rabbitbrush dunes, snakeweed/galleta upland, and pinyon/juniper sagebrush hills (leaving each with 3) and placed in certain special habitat features we felt were important enough to require trapping. Only 2 transects were established in the ricegrass/snakeweed dunes because of its small size and limited distribution. The remaining SHS's contained four transects each.

Trapping was conducted for three consecutive nights at each sample site. Captured animals were identified, aged, sexed, and individually marked with a waterproof felt tip pen for recognition of recaptures. Standard museum measurements were also taken on each specimen. Snap-trapped animals were identified, aged, sexed, and frozen for laboratory processing. All trapping data was recorded on ADO Form 6610-1. The location of each sample site was recorded on a 7.5 min. USGS topographic map.

Preliminary verification of small mammal identification was obtained from the Museum of Southwestern Biology, University of New Mexico, Albuquerque. Up to 10 voucher specimens of each species were prepared and cataloged according to the museum's specifications and delivered to them. Positive identification will not be available prior to the

release of this report but will be available from either the author or the BLM's Farmington Resource Area Office.

Bat Survey

Collection of information on bats was attempted through mist netting and electronic monitoring. Mist nets were placed at likely locations of bat activity such as waterholes and canyons for three consecutive nights from dusk until midnight. At least one net during each session remained in position all night to capture species which forage after midnight. Monitoring was conducted simultaneously with netting and also randomly as time permitted.

Although mist netting enables in-hand identification and either collection or release of specimens, it has a relatively low success rate and selects against species that show a high degree of net avoidance capabilities. The monitoring device enables the collection of data without disrupting the bats' normal behavior; however, identification of individual species has not been perfected.

Driving Surveys and Lagomorph Data from Bird Survey Transects

Several night driving surveys were conducted during each season to obtain a relative abundance for lagomorphs and determine the presence of nocturnal animals that may otherwise go undetected. Each survey was started about one-half hour after sunset and completed within 2 hours.

Vehicle speed was approximately 25 mph and a handheld spotlight was used to facilitate sightings. The time, approximate location, habitat type, and age (if possible) was recorded for each animal sighted.

Lagomorph sightings were also recorded along the 1.6 kilometer songbird transects in each vegetation type.

Aerial Surveys

Aerial surveys were completed once during each seasonal sample period. Flights were conducted on two consecutive days from 7:00 AM to 11:00 AM in a Cessna 182 aircraft. Calendar dates of flights were November 9 and 10, 1980, February 3 and 4, May 9 and 10, and July 19 and 20, 1981. The study area was flown in somewhat parallel transects approximately 1.6 to 2.4 km apart at an altitude of 60 to 120 m and a speed of 80 knots. The primary purpose of the aerial surveys was to determine the number and distribution of pronghorn and document the location of prairie dog towns.

Scent Post Stations

Scent post stations were established to gather information on study area carnivores. Originally, scent posts were to be used according to the guidelines of USFWS Predator Control Unit, and one such transect was established in November of 1980. However, due to the physical restraints of the method and the need for a long-term study in order for

the data to be meaningful, that technique was abandoned. The method adopted was to place a single scent post near each transect in suitable habitat. The ground around the post was finely sifted and leveled. After checking for tracks each day, the area was smoothed out for the next night. If rain or wind had diluted the scent capsule, it was replaced. Materials for the scent posts were contained in kits prepared by the USFWS and purchased from their supply depot in Pocatello, Idaho.

Prairie Dog Survey

Prairie dog (*Cynomys gunnisoni*) concentrations were documented through ground observations and aerial surveys. Field personnel recorded all observations of prairie dogs and documented the location of burrows. During the summer of 1981, flights of 3 hours duration were conducted on two consecutive days (July 19 and 20) to delineate the boundaries of prairie dog towns (see Aerial Survey for flight procedures). Ground truthing of the identified colonies was completed in late August of 1981. Each colony which was identified during the flight was located on the ground and the boundaries checked for accuracy. Corrections were made and delineated on 7.5 min. USGS quad maps.

Results and Discussion

Table 9 presents a list of mammalian species of which occurrence was documented through detection of sign (tracks, scats, etc.) or actual

Table 9. Mammalian species occurrence, habitat preference, and relative abundance[1], Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Observed on Survey	Incidental Sighting	Treated Sagebrush	Ricegrass/Snakeweed Dunes	Badlands	Snakeweed/Galleta Uplands	Sagebrush/Galleta Rolling Uplands	Alkali Sacaton/Annual Atriplex Swale	Greasewood/Rabbitbrush Dunes	Pinyon-Juniper/Sagebrush Hills	Greasewood/Alkali Sacaton Drainage	Mixed Shrub Rolling Upland	Pinyon-Juniper Hills	Rock Outcrop	Dry Lake Bed
Yuma myotis	X			U											
Silver-haired bat	X												U		
Western pipistrel	X													U	
Townsend's big-eared bat	X													R	
Pallid bat	X													U	
Desert cottontail	X	X		C		U	C	U	C	C	C	U	C		
Black-tailed jackrabbit	X	X		U		U	C	C	C	C	C	C	U		
Colorado chipmunk	X	X								C			C		
White-tailed antelope squirrel	X	X				U	U		C	C	C	C	U	U	U
Spotted ground squirrel	X	X	U	U		U	U	U	C	U	U	C		U	
Rock squirrel	X	X								R					
Gunnison's prairie dog[2]		X	U	C		C	U	C				U			
Botta's pocket gopher[2]	X			C		U	C	U	C	C		C	U	U	
Plains pocket mouse	X					C	U		U	U		U		C	
Silky pocket mouse	X		U	C	U	C	C	C	U	U	C	C	U	C	
Ord's kangaroo rat	X		U	C		C	U	C	C	C		A		C	
Banner-tailed kangaroo rat	X					U	U					U			

Table 9. Continued

Species	Observed on Survey	Incidental Sighting	Treated Sagebrush	Ricegrass/Snakeweed Dunes	Badlands	Snakeweed/Galleta Uplands	Sagebrush/Galleta Rolling Uplands	Alkali Sacaton/Annual Atriplex Swale	Greasewood/Rabbitbrush Dunes	Pinyon-Juniper/Sagebrush Hills	Greasewood/Alkali Sacaton Drainage	Mixed Shrub Rolling Upland	Pinyon-Juniper Hills	Rock Outcrop	Dry Lake Bed
Western harvest mouse	X				U	U		U	U	U	A	C	U	U	
Deer mouse	X		U	U	A	C	A	A	C	C	A	C	A	A	A
Canyon mouse	X												U	U	
Pinyon mouse	X								U	C	U		A	C	
Northern grasshopper mouse	X			U		U	U	C	C	U	U	C		U	
White-throated woodrat	X				U					U			C		
Stephens woodrat	X													U	
Bushy-tailed woodrat[4]	X												U	U	
Porcupine		X			U					U					
Coyote		X	U	U	U	U	C	C	U	C	U	C	C	U	U
Red fox		X				R					R				
Kit fox	X	X	U	U	U	U	U	U	U	U	U	U	U	U	U
Badger		X		U								U			
Mountain lion[3]		X											U		
Bobcat		X											U	U	
Mule deer[3]		X											U		
Pronghorn	X	X					U					U			
Total Number of Species			7	13	7	16	15	12	14	18	12	17	18	19	4
Diversity Index			1.06	1.28	.48	.85	.98	.92	1.48	1.89	.90	1.34	1.41	1.89	.11

[1]R - rare; U - uncommon; C - common; A - abundant (see text for an explanation of abundance categories).

[2]Abundance determined by sign, not actual captures.

[3]Sign only, no actual observation.

[4]The bushy-tailed woodrat is probably common as indicated by abundant sign; however, they were difficult to trap successfully.

observation on the project area. In addition, it shows whether the species was observed during a programmed sample, or incidentally and gives habitat preferences, gross distribution, and status (relative abundance). It should be pointed out that the information presented in Table 9 is what occurred during a one-year study and an attempt to draw further conclusions concerning habitat affinities would be highly judgemental. No observation was made of the sign or the actual individual of a species considered endangered or threatened during the course of the study.

The status or abundance of study area mammals is also variable, and in some cases judgemental. However, like preference and distribution, it is a means of viewing habitat utilization and significance for most mammals occurring on-site. The abundance categories as described in the introduction to Task 5 were used to describe abundance for all mammal species except the rodents. The relative abundance of rodents was determined by the number trapped and categorized as follows:

Uncommon	1-9 captures
Common	10-49 captures
Abundant	50 or more captures
Rare	See Task 5, Introduction

Small Mammal Trapping

Tables 10 through 14 present a breakdown of the trapping results by species and sex for each standard habitat site and special habitat feature according to season and the entire study. Tables 15 through 19 present a summary of trapping success encountered during each seasonal sample period and for the entire study within each habitat site. The bats and pocket gophers are not included on these tables but are discussed in separate sections. A list of species trapped on each transect including those taken as voucher specimens can be found in Appendix C.

Recaptures are included in the total number of captures on Tables 15 through 19 which explains the difference in the totals as compared to Tables 10 through 14. Each figure for capture per unit effort (CE) on Tables 15 through 19 was multiplied by 100 to make these numbers more easily understood. Some of these figures are quite small and it was felt they would be more meaningful if enlarged by a factor of 100.

A total of 23,555 trap-nights produced a capture of 1,913 rodents comprising 16 species over the course of the study. The fall sample represented 19% of the yearly total with 370 total captures. The winter sample had the smallest capture with 245 (13% of yearly total). The spring and summer were almost equal in captures with 632 (33%) and 666 (35%), respectively.

The variation in the number of individuals trapped per season is about what would be expected. The spring and summer samples were highest because trapping was conducted during and after breeding, thus

(Text continued on page 97)

Table 10. Quantitative composition, by sex, of small mammals captured during the fall sampling season in 11 standard habitat sites and 2 special habitat features in the Chaco Strippable Coal Wildlife Study Area, New Mexico.

		STANDARD HABITAT SITES (SHS)										Special Features		Totals		
Species	Sex	Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Ammospermophilus teucurus	M			2									3		2	3	5
	F	2		2		1			1						6		6
	Unk					1							1		1	1	2
	Total	2		4		2			1				4		9	4	13
Dipodomys ordii	M	2	1	7		5			1			1	1		17	1	18
	F	1		5		1	1		4			3			15		15
	Unk					1			2						3		3
	Total	3	1	12		7	1		7			4	1		35	1	36
Dipodomys spectabilis	M																
	F																
	Unk																
	Total																
Eutamias quadrivittatus	M																
	F																
	Unk																
	Total																
Neotoma albigula	M							1							1		1
	F							4							4		4
	Unk							1							1		1
	Total							6							6		6
Neotoma cinerea	M																
	F																
	Unk																
	Total																
Neotoma stephensi	M												1			1	1
	F												2			2	2
	Unk												1			1	1
	Total												4			4	4
Onychomys leucogaster	M	1		6						3		2			12		12
	F	1	1	3		3				2		1			11		11
	Unk	1													1		1
	Total	3	1	9		3				5		3			24		24
Perognathus flavus	M	1			2	1				1		1	1		6	1	7
	F	1	2			3							1		6	1	7
	Unk	1													1		1
	Total	3	2		2	4				1		1	2		13	2	15

Table 10. Continued

Species	Sex	STANDARD HABITAT SITES (SHS)											Special Features		Totals		
		Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Perognathus flavescens	M																
	F																
	Unk																
	Total																
Peromyscus crinitus	M																
	F																
	Unk																
	Total																
Peromyscus maniculatus	M	4		12	9	5	4	1	11	10	10		2	44	66	46	112
	F	1		5	6	6		5	3	10	1		10	44	37	54	91
	Unk	1			2	1			1	1			6	1	6	7	13
	Total	6		17	17	12	4	6	15	21	11		18	89	109	107	216
Peromyscus truei	M							16	2				2		18	2	20
	F							17	7				1		24	1	25
	Unk								1						1		1
	Total							33	10				3		43	3	46
Reithrodontomys megalotis	M			2	1						3		2		6	2	8
	F												2			2	2
	Unk																
	Total			2	1						3		4		6	4	10
Spermophilus spilosoma	M																
	F																
	Unk																
	Total																
Spermophilus variegatus	M																
	F																
	Unk																
	Total																
Total of all species combined	M	8	1	29	12	11	4	18	14	14	13	4	12	44	128	56	184
	F	6	3	15	6	14	1	26	15	12	1	4	16	44	103	60	163
	Unk	3			2	3		1	4	1			8	1	14	9	23
Total captures per habitat site[1]		17	4	44	20	28	5	45	33	27	14	8	36	89	245	125	370

[1]Does not include recaptures.

Table 11. Quantitative composition, by sex, of small mammals captured during the winter sampling season in 11 standard habitat sites and 2 special habitat features in the Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Sex	STANDARD HABITAT SITES (SHS)											Special Features		Totals		
		Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Ammospermophilus leucurus	M	1									1				2		2
	F			1							1				2		2
	Unk																
	Total	1		1							2				4		4
Dipodomys ordii	M	1		1			1		1						4		4
	F			4		1			2			1	1		8	1	9
	Unk									1					1		1
	Total	1		5		1	1		3	1		1	1		13	1	14
Dipodomys spectabilis	M																
	F																
	Unk																
	Total																
Eutamias quadrivittatus	M																
	F																
	Unk																
	Total																
Neotoma albigula	M							1	1						2		2
	F							1							1		1
	Unk																
	Total							2	1						3		3
Neotoma cinerea	M							1							1		1
	F																
	Unk																
	Total							1							1		1
Neotoma stephensi	M																
	F																
	Unk																
	Total																
Onychomys leucogaster	M	1	1	2						2					6		6
	F		1	1					1			1			4		4
	Unk																
	Total	1	2	3					1	2		1			10		10
Perognathus flavus	M		8			3				1	1				13		13
	F		4			1				2	1	3			11		11
	Unk									1					1		1
	Total		12			4				4	2	3			25		25

Table 11. Continued

Species	Sex	STANDARD HABITAT SITES (SHS)											Special Features		Totals		
		Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Perognathus flavescens	M																
	F																
	Unk																
	Total																
Peromyscus crinitus	M							1							1		1
	F							1							1		1
	Unk																
	Total							2							2		2
Peromyscus maniculatus	M	5	4	4	6	9		7	2	4	11	1	4	21	53	25	78
	F	3	3	2	3	5		3	1	2	10		1	18	32	19	51
	Unk						1		1		3		1	2	5	3	8
	Total	8	7	6	9	14	1	10	4	6	24	1	6	41	90	47	137
Peromyscus truei	M							18	5						23		23
	F							10	6				1		16	1	17
	Unk																
	Total							28	11				1		39	1	40
Reithrodontomys megalotis	M										4				4		4
	F	1									3				4		4
	Unk										1				1		1
	Total	1									8				9		9
Spermophilus spilosoma	M																
	F																
	Unk																
	Total																
Spermophilus variegatus	M																
	F																
	Unk																
	Total																
Total of all species combined	M	8	13	7	6	12	1	28	9	7	17	1	4	21	109	25	134
	F	4	8	8	3	7		15	10	4	15	5	3	18	79	21	100
	Unk						1		1	2	4		1	2	8	3	11
Total captures per habitat site[1]		12	21	15	9	19	2	43	20	13	36	6	8	41	196	49	245

[1]Does not include recaptures.

Table 12. Quantitative composition, by sex, of small mammals during the spring sampling season in 11 standard habitat sites and 2 special habitat features in the Chaco Strippable Coal Wildlife Study Area, New Mexico.

		STANDARD HABITAT SITES (SHS)											Special Features		Totals		
Species	Sex	Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Ammospermophilus leucurus	M	3	2	1					4		1			1	11	1	12
	F	4		1					4				2		9	2	11
	Unk		1					1	1						3		3
	Total	7	3	2				1	9		1		2	1	23	3	26
Dipodomys ordii	M	6	7	16		1			9	4		4	3		47	3	50
	F	9	4	14		2			5	1		4	1		39	1	40
	Unk			2											2		2
	Total	15	11	32		3			14	5		8	4		88	4	92
Dipodomys spectabilis	M		2												2		2
	F			1		1									2		2
	Unk																
	Total		2	1		1									4		4
Eutamias quadrivittatus	M							1	2						3		3
	F								3						3		3
	Unk																
	Total							1	5						6		6
Neotoma albigula	M							3							3		3
	F							1						1	1	1	2
	Unk																
	Total							4						1	4	1	5
Neotoma cinerea	M							1							1		1
	F							1							1		1
	Unk							1							1		1
	Total							3							3		3
Neotoma stephensi	M																
	F																
	Unk																
	Total																
Onychomys leucogaster	M	6		6		1			1	1	1	1			17		17
	F	2	1	5		3				3		1			15		15
	Unk		1												1		1
	Total	8	2	11		4			1	4	1	2			33		33
Perognathus flavus	M			4	1	7				5	7	3	3		27	3	30
	F			1		4	1		1	8	3	4	4		22	4	26
	Unk			1	1										2		2
	Total			6	2	11	1		1	13	10	7	7		51	7	58

Table 12. Continued

Species	Sex	STANDARD HABITAT SITES (SHS)											Special Features		Totals		
		Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Perognathus flavescens	M		21	1									3		22	3	25
	F		12												12		12
	Unk																
	Total		33	1									3		34	3	37
Peromyscus crinitus	M																
	F							2							2		2
	Unk																
	Total							2							2		2
Peromyscus maniculatus	M	4	1	4	10	5		14	7	13	16		7	15	74	22	96
	F	2	6	5	8	13		10	5	9	15	1	5	25	74	30	104
	Unk					1		1		2				1	4	1	5
	Total	6	7	9	18	19		25	12	24	31	1	12	41	152	53	205
Peromyscus truei	M							34	6				2		40	2	42
	F							23	7		1		2		31	2	33
	Unk							1							1		1
	Total							58	13		1		4		72	4	76
Reithrodontomys megalotis	M	2		4				1			6				13		13
	F	1	1	5				1	1		6				15		15
	Unk										1				1		1
	Total	3	1	9				2	1		13				29		29
Spermophilus spilosoma	M	12		13			1					1			27		27
	F	9	1	12		1			2			2	1		27	1	28
	Unk																
	Total	21	1	25		1	1		2			3	1		54	1	55
Spermophilus variegatus	M																
	F								1						1		1
	Unk																
	Total								1						1		1
Total of all species combined	M	33	33	49	11	14	1	54	29	23	31	9	18	16	287	34	321
	F	27	25	44	8	24	1	38	29	21	25	12	15	26	254	41	295
	Unk		2	3	1	1		4	1	2	1			1	15	1	16
Total captures per habitat site[1]		60	60	96	20	39	2	96	59	46	57	21	33	43	556	76	632

[1]Does not include recaptures.

Table 13. Quantitative composition, by sex, of small mammals during the summer sampling season in 11 standard habitat sites and 2 special habitat features in the Chaco Strippable Coal Wildlife Study Area, New Mexico.

		STANDARD HABITAT SITES (SHS)											Special Features		Totals		
Species	Sex	Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Ammospermophilus leucurus	M	6		7		4		1	5		4			1	27	1	28
	F	4		4		1			6		2		1		17	1	18
	Unk			3		1			1		1				6		6
	Total	10		14		6		1	12		7		1	1	50	2	52
Dipodomys ordii	M	15		18		5			11	4			1		53	1	54
	F	3		8		5			3	1			4		20	4	24
	Unk	1				1						2	1		4	1	5
	Total	19		26		11			14	5		2	6		77	6	83
Dipodomys spectabilis	M		2												2		2
	F		1			1									2		2
	Unk																
	Total		3			1									4		4
Eutamias quadrivittatus	M							5	8						13		13
	F							3	5						8		8
	Unk							4	1						5		5
	Total							12	14						26		26
Neotoma albigula	M				1			4	1						6		6
	F							3						1	3	1	4
	Unk																
	Total				1			7	1					1	9	1	10
Neotoma cinerea	M							2					3		2	3	5
	F							1					1		1	1	2
	Unk							1							1		1
	Total							4					4		4	4	8
Neotoma stephensi	M																
	F																
	Unk																
	Total																
Onychomys leucogaster	M	2	1	2						1	1	1	1		8	1	9
	F	3		2					1	2					8		8
	Unk										1				1		1
	Total	5	1	4					1	3	2	1	1		17	1	18
Perognathus flavus	M		9	5	3	10	2	3	5	7	12	9	2		65	2	67
	F	2	4	2	2	6		3		11	9	3			42		42
	Unk			1		1		2		2	1	1			8		8
	Total	2	13	8	5	17	2	8	5	20	22	13	2		115	2	117

Table 13. Continued

Species	Sex	STANDARD HABITAT SITES (SHS)											Special Features		Totals		
		Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Perognathus flavescens	M	2		3					2				5		7	5	12
	F	1				1							2		2	2	4
	Unk																
	Total	3		3		1			2				7		9	7	16
Peromyscus crinitus	M							1							1		1
	F																
	Unk																
	Total							1							1		1
Peromyscus maniculatus	M	2	1	4	15	6	1	23	5	9	12		10	26	78	36	114
	F			2	9	3	1	7	3	7	9		7	25	41	32	73
	Unk				3	2		3						4	8	4	12
	Total	2	1	6	27	11	2	33	8	16	21		17	55	127	72	199
Peromyscus truei	M							19	5				5		24	5	29
	F	1						9	6				3		16	3	19
	Unk							2							2		2
	Total	1						30	11				8		42	8	50
Reithrodontomys megalotis	M	2			2					1	17		3		22	3	25
	F	1			1					1	15		1		18	1	19
	Unk																
	Total	3			3					2	32		4		40	4	44
Spermophilus spilosoma	M	3		7			1		1	1	1	1			15		15
	F	5		12					1	2		1			21		21
	Unk			2					1						3		3
	Total	8		21			1		3	3	1	2			39		39
Spermophilus variegatus	M																
	F																
	Unk																
	Total																
Total of all species combined	M	32	13	46	21	25	4	58	43	23	47	11	30	27	323	57	380
	F	20	5	30	12	17	1	26	25	24	35	4	19	25	199	44	243
	Unk	1		6	3	5		12	3	2	3	3	1	4	38	5	43
Total captures per habitat site[1]		53	18	82	36	47	5	96	71	49	85	18	50	56	560	106	666

[1]Does not include recaptures.

Table 14. Quantitative composition, by sex, of small mammals during the entire year in 11 standard habitat sites and 2 special habitat features in the Chaco Strippable Coal Wildlife Study Area, New Mexico.

		STANDARD HABITAT SITES (SHS)											Special Features		Totals		
Species	Sex	Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Ory Lake Bed	SHS Combined	Special Features Combined	All Habitats
Ammospermophilus leucurus	M	10	2	10		4		1	9		6		3	2	42	5	47
	F	10		8		2			11		3		3		34	3	37
	Unk		1	3		2		1	2		1		1		10	1	11
	Total	20	3	21		8		2	22		10		7	2	86	9	95
Dipodomys ordii	M	24	8	42		11	1		22	8		5	5		121	5	126
	F	13	4	31		9	1		14	2		8	6		82	6	88
	Unk	1		2		2			2	1		2	1		10	1	11
	Total	38	12	75		22	2		38	11		15	12		213	12	225
Dipodomys spectabilis	M		4												4		4
	F		1	1		2									4		4
	Unk																
	Total		5	1		2									8		8
Eutamias quadrivittatus	M							6	10						16		16
	F							3	8						11		11
	Unk							4	1						5		5
	Total							13	19						32		32
Neotoma albigula	M				1			9	2						12		12
	F							9						2	9	2	11
	Unk							1							1		1
	Total				1			19	2					2	22	2	24
Neotoma cinerea	M							4					3		4	3	7
	F							2					1		2	1	3
	Unk							2							2		2
	Total							8					4		8	4	12
Neotoma stephensi	M												1			1	1
	F												2			2	2
	Unk												1			1	1
	Total												4			4	4
Onychomys leucogaster	M	10	2	16		1			1	7	2	4	1		43	1	44
	F	6	3	11		6			2	7		3			38		38
	Unk	1	1								1				3		3
	Total	17	6	27		7			3	14	3	7	1		84	1	85
Perognathus flavus	M	1	17	9	6	21	2	3	5	14	20	13	6		111	6	117
	F	3	10	3	2	14	1	3	1	21	13	10	5		81	5	86
	Unk	1		2	1	1		2		3	1	1			12		12
	Total	5	27	14	9	36	3	8	6	38	34	24	11		204	11	215

Table 14. Continued

Species	Sex	STANDARD HABITAT SITES (SHS)										Special Features		Totals		
		Greasewood-Rabbitbrush Dunes	Snakeweed-Galletta Uplands	Mixed Shrub Rolling Uplands	Badlands	Sagebrush Galleta Rolling Uplands	Treated Sage	Pinyon-Juniper Hills	Pinyon Juniper Sagebrush Hills	Alkali Sacaton Annual Atriplex Swale	Greasewood Alkali-Sacaton Drainage	Ricegrass Snakeweed Dunes	Rock Outcrop	Dry Lake Bed	SHS Combined	Special Features Combined	All Habitats
Perognathus flavescens	M	2	21	4					2				8		29	8	37
	F	1	12			1							2		14	2	16
	Unk																
	Total	3	33	4		1			2				10		43	10	53
Peromyscus crinitus	M							2							2		2
	F							3							3		3
	Unk																
	Total							5							5		5
Peromyscus maniculatus	M	15	6	24	40	25	5	45	25	36	49	1	23	106	271	129	400
	F	6	9	14	26	27	1	25	12	28	35	1	23	112	184	135	319
	Unk	1			5	4	1	4	2	3	3		7	8	23	15	38
	Total	22	15	38	71	56	7	74	39	67	87	2	53	226	478	279	757
Peromyscus truei	M							87	18				9		105	9	114
	F	1						59	26		1		7		87	7	94
	Unk							3	1						4		4
	Total	1						149	45		1		16		196	16	212
Reithrodontomys megalotis	M	4		6	3			1		1	30		5		45	5	50
	F	3	1	5	1			1	1	1	24		3		37	3	40
	Unk										2				2		2
	Total	7	1	11	4			2	1	2	56		8		84	8	92
Spermophilus spilosoma	M	15		20			2		1	1	1	2			42		42
	F	14	1	24		1			3	2		3	1		48	1	49
	Unk			2					1						3		3
	Total	29	1	46		1	2		5	3	1	5	1		93	1	94
Spermophilus variegatus	M								1								
	F														1		1
	Unk																
	Total								1						1		1
Total of all species combined	M	81	60	131	50	62	10	158	96	67	108	25	64	108	847	172	1019
	F	57	41	97	29	62	3	105	78	61	76	25	53	113	635	166	801
	Unk	4	2	9	6	9	1	17	9	7	8	3	10	8	75	18	93
Total captures per habitat site[1]		142	103	237	85	133	14	280	183	135	192	53	127	229	1557	356	1913

[1]Does not include recaptures.

Table 15. Total trap nights (TN), total captures (TC)[1], and captures per unit effort (CE)[2] of small mammals during the fall 1980 sample, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Sites (SHS)											
	Greasewood-Rabbitbrush Dunes TN = 444		Snakeweed-Galletta Uplands TN = 450		Mixed Shrub Rolling Uplands TN = 732		Badlands TN = 579		Sagebrush Galleta Rolling Uplands TN = 585		Treated Sage TN = 148	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	2	0.45			4	0.55			2	0.34		
Dipodomys ordii	3	0.68	1	0.22	12	1.64			7	1.20	1	0.68
Dipodomys spectabilis												
Eutamias quadrivittatus												
Neotoma albigula												
Neotoma cinerea												
Neotoma stephensi												
Onychomys leucogaster	3	0.68	1	0.22	9	1.23			3	0.51		
Perognathus flavus	3	0.68	2	0.44			2	0.35	4	0.68		
Perognathus flavescens												
Peromyscus crinitus												
Peromyscus maniculatus	6	1.35			17	2.32	17	2.94	12	2.05	4	2.70
Peromyscus truei												
Reithrodontomys megalotis					2	0.27	1	0.17				
Spermophilus spilosoma												
Spermophilus variegatus												
Total[1]	18	4.05	4	0.89	41	5.60	25	4.32	37	6.32	6	4.05

[1]Includes recaptures.

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 15. Continued

Species	Standard Habitat Sites (SHS)									
	Pinyon-Juniper Hills TN = 594		Pinyon Juniper Sagebrush Hills TN = 402		Alkali Sacaton Annual Atriplex Swale TN = 600		Greasewood Alkali-Sacaton Drainage TN = 594		Ricegrass Snakeweed Dunes TN = 299	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus			1	0.25						
Dipodomys ordii			7	1.74					4	1.34
Dipodomys spectabilis										
Eutamias quadrivittatus										
Neotoma albigula	6	1.01								
Neotoma cinerea										
Neotoma stephensi										
Onychomys leucogaster					5	0.83			3	1.00
Perognathus flavus					1	0.17			1	0.33
Perognathus flavescens										
Peromyscus crinitus										
Peromyscus maniculatus	6	1.01	15	3.73	21	3.50	11	1.85		
Peromyscus truei	33	5.56	10	2.49						
Reithrodontomys megalotis							3	0.51		
Spermophilus spilosoma										
Spermophilus variegatus										
Total[1]	58	9.76	40	9.96	31	5.17	16	2.69	11	3.68

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 15. Continued

Species	Special Features				Totals					
	Rock Outcrop TN = 300		Dry Lake Bed TN = 127		SHS Combined TN = 5427		Special Features Combined TN = 427		All Habitat Types TN = 5854	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	4	1.33			9	0.17	4	0.94	13	0.22
Dipodomys ordii	1	0.33			35	0.64	1	0.23	36	0.61
Dipodomys spectabilis										
Eutamias quadrivittatus										
Neotoma albigula					6	0.11			6	0.10
Neotoma cinerea										
Neotoma stephensi	4	1.33					4	0.94	4	0.07
Onychomys leucogaster					25	0.46			25	0.43
Perognathus flavus	2	0.67			13	0.24	2	0.47	15	0.26
Perognathus flavescens										
Peromyscus crinitus										
Peromyscus maniculatus	18	6.00	89	70.08	109	7.54	107	25.06	216	3.69
Peromyscus truei	3	1.00			43	0.79	3	0.70	46	0.79
Reithrodontomys megalotis	4	1.33			6	0.11	4	0.94	10	0.17
Spermophilus spilosoma										
Spermophilus variegatus										
Total[1]	47	15.67	100	78.74	287	5.29	147	34.43	434	7.41

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN}$ X 100 (see page 70).

Table 16. Total trap nights (TN), total captures (TC)[1], and captures per unit effort (CE)[2] of small mammals during the winter 1981 sample, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Sites (SHS)											
	Greasewood-Rabbitbrush Dunes TN = 444		Snakeweed-Galletta Uplands TN = 450		Mixed Shrub Rolling Uplands TN = 748		Badlands TN = 598		Sagebrush Galleta Rolling Uplands TN = 600		Treated Sage TN = 150	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	1	0.23			1	0.13						
Dipodomys ordii	1	0.23			5	0.67			1	0.17	1	0.67
Dipodomys spectabilis												
Eutamias quadrivittatus												
Neotoma albigula												
Neotoma cinerea												
Neotoma stephensi												
Onychomys leucogaster	1	0.23	2	0.44	3	0.40						
Perognathus flavus			12	2.67					4	0.67		
Perognathus flavescens												
Peromyscus crinitus												
Peromyscus maniculatus	8	1.80	7	1.56	6	0.80	9	1.51	14	2.33	1	0.67
Peromyscus truei												
Reithrodontomys megalotis	1	0.23										
Spermophilus spilosoma												
Spermophilus variegatus												
Total[1]	12	2.70	23	5.10	17	2.27	10	1.67	27	4.50	2	1.33

[1]Includes recaptures.

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 16. Continued

Species	Standard Habitat Sites (SHS)									
	Pinyon-Juniper Hills TN = 520		Pinyon Juniper Sagebrush Hills TN = 450		Alkali Sacaton Annual Atriplex Swale TN = 588		Greasewood Alkali-Sacaton Drainage TN = 598		Ricegrass Snakeweed Dunes TN = 300	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus							2	0.33		
Dipodomys ordii			3	0.67	1	0.17			1	0.33
Dipodomys spectabilis										
Eutamias quadrivittatus										
Neotoma albigula	2	0.38	1	0.22						
Neotoma cinerea	1	0.19								
Neotoma stephensi										
Onychomys leucogaster			1	0.22	2	0.34			1	0.33
Perognathus flavus					4	0.68	2	0.33	3	1.00
Perognathus flavescens										
Peromyscus crinitus	2	0.38								
Peromyscus maniculatus	10	1.92	4	0.89	6	1.02	24	4.01	1	0.33
Peromyscus truei	28	5.38	11	2.44						
Reithrodontomys megalotis							8	1.34		
Spermophilus spilosoma										
Spermophilus variegatus										
Total[1]	50	9.62	26	5.78	19	3.23	41	6.86	6	2.00

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 16. Continued

Species	Special Features				Totals					
	Rock Outcrop TN = 291		Dry Lake Bed TN = 150		SHS Combined TN = 5446		Special Features Combined TN = 441		All Habitat Types TN = 5887	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus					4	0.07			4	0.07
Dipodomys ordii	1	0.34			13	0.24	1	0.23	14	0.24
Dipodomys spectabilis										
Eutamias quadrivittatus										
Neotoma albigula					3	0.06			3	0.05
Neotoma cinerea					1	0.02			1	0.02
Neotoma stephensi										
Onychomys leucogaster					9	0.17			9	0.15
Perognathus flavus					25	0.46			25	0.42
Perognathus flavescens										
Peromyscus crinitus					2	0.04			2	0.03
Peromyscus maniculatus	6	2.06	41	27.33	90	1.65	47	10.66	137	2.33
Peromyscus truei	1	0.34			39	0.72	1	0.23	40	0.68
Reithrodontomys megalotis					9	0.17			9	0.15
Spermophilus spilosoma										
Spermophilus variegatus										
Total[1]	11	3.78	44	29.33	233	4.28	55	12.47	288	4.89

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN}$ X 100 (see page 70).

Table 17. Total trap nights (TN), total captures (TC)[1], and captures per unit effort of small mammals during the spring 1981 sample, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Sites (SHS)											
	Greasewood-Rabbitbrush Dunes TN = 436		Snakeweed-Galletta Uplands TN = 450		Mixed Shrub Rolling Uplands TN = 727		Badlands TN = 593		Sagebrush Galleta Rolling Uplands TN = 595		Treated Sage TN = 150	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	7	1.61	3	0.67	2	0.28						
Dipodomys ordii	15	3.44	11	2.44	32	4.40			3	0.50		
Dipodomys spectabilis			2	0.44	1	0.14			1	0.17		
Eutamias quadrivittatus												
Neotoma albigula												
Neotoma cinerea												
Neotoma stephensi												
Onychomys leucogaster	8	1.83	2	0.44	11	1.51			4	0.67		
Perognathus flavus					6	0.83	2	0.34	11	1.85	1	0.67
Perognathus flavescens			33	7.33	1	0.14						
Peromyscus crinitus												
Peromyscus maniculatus	6	1.38	7	1.56	9	1.24	18	3.04	19	3.19		
Peromyscus truei												
Reithrodontomys megalotis	3	0.69	1	0.22	9	1.24						
Spermophilus spilosoma	21	4.82	1	0.22	25	3.44			1	0.17	1	0.67
Spermophilus variegatus												
Total[1]	75	17.20	9	2.00	108	14.86	23	3.88	49	8.24	2	1.33

[1]Includes recaptures.

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 17. Continued

Species	Standard Habitat Sites (SHS)									
	Pinyon-Juniper Hills TN = 599		Pinyon Juniper Sagebrush Hills TN = 447		Alkali Sacaton Annual Atriplex Swale TN = 595		Greasewood Alkali-Sacaton Drainage TN = 595		Ricegrass Snakeweed Dunes TN = 295	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	1	0.17	9	2.01			1	0.17		
Dipodomys ordii			14	3.13	5	0.84			8	2.71
Dipodomys spectabilis										
Eutamias quadrivittatus	1	0.17	5	1.12						
Neotoma albigula	4	0.67								
Neotoma cinerea	3	0.50								
Neotoma stephensi										
Onychomys leucogaster			1	0.22	4	0.67	1	0.17	2	0.68
Perognathus flavus			1	0.22	13	2.18	10	1.68	7	2.37
Perognathus flavescens										
Peromyscus crinitus	2	0.33								
Peromyscus maniculatus	25	4.17	12	2.68	24	4.03	31	5.21	1	0.34
Peromyscus truei	57	9.52	13	2.91			1	0.17		
Reithrodontomys megalotis	2	0.33	1	0.22			13	2.18		
Spermophilus spilosoma			2	0.45					3	1.02
Spermophilus variegatus			1	0.22						
Total[1]	109	18.20	72	16.11	51	8.57	60	10.08	27	9.15

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN}$ X 100 (see page 70).

Table 17. Continued

Species	Special Features				Totals					
	Rock Outcrop TN = 299		Dry Lake Bed TN = 150		SHS Combined TN = 5482		Special Features Combined TN = 449		All Habitat Types TN = 5931	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	2	0.67	1	0.67	23	0.42	3	0.67	26	0.44
Dipodomys ordii	4	1.34			88	1.61	4	0.89	92	1.55
Dipodomys spectabilis					4	0.07			4	0.07
Eutamias quadrivittatus					6	0.11			6	0.10
Neotoma albigula			1	0.67	4	0.07	1	0.22	5	0.08
Neotoma cinerea					3	0.05			3	0.05
Neotoma stephensi										
Onychomys leucogaster					33	0.60			33	0.56
Perognathus flavus	7	2.34			51	0.93	7	1.56	58	0.98
Perognathus flavescens	3	1.00			34	0.62	3	0.67	37	0.62
Peromyscus crinitus					2	0.04			2	0.03
Peromyscus maniculatus	12	4.01	41	27.33	164	2.99	53	11.80	217	3.66
Peromyscus truei	4	1.34			70	1.28	4	0.89	74	1.25
Reithrodontomys megalotis					29	0.53			29	0.49
Spermophilus spilosoma	1	0.33			54	0.99	1	0.22	55	0.93
Spermophilus variegatus					1	0.02			1	0.02
Total[1]	37	12.37	47	31.11	585	10.67	84	18.71	669	11.28

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 18. Total trap nights (TN), total captures (TC)[1], and captures per unit effort (CE)[2] of small mammals during the summer 1981 sample, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Sites (SHS)											
	Greasewood-Rabbitbrush Dunes TN = 444		Snakeweed-Galletta Uplands TN = 449		Mixed Shrub Rolling Uplands TN = 746		Badlands TN = 590		Sagebrush Galleta Rolling Uplands TN = 593		Treated Sage TN = 598	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	10	2.25			14	1.88			6	1.01		
Dipodomys ordii	19	4.28			26	3.49			11	1.86		
Dipodomys spectabilis			3	0.67					1	0.17		
Eutamias quadrivittatus												
Neotoma albigula							1	0.17				
Neotoma cinerea												
Neotoma stephensi												
Onychomys leucogaster	5	1.13	1	0.22	4	0.54						
Perognathus flavus	2	0.45	13	2.90	8	1.07	5	0.85	17	2.87	2	1.33
Perognathus flavescens	3	0.68			3	0.40			1	0.17		
Peromyscus crinitus												
Peromyscus maniculatus	2	0.45	1	0.22	6	0.80	27	4.58	11	1.86	2	1.33
Peromyscus truei	1	0.23										
Reithrodontomys megalotis	3	0.68							3	0.51		
Spermophilus spilosoma	8	1.80			21	2.82					1	0.67
Spermophilus variegatus												
Total[1]	59	13.29	21	4.68	96	12.87	41	6.95	58	9.78	5	3.33

[1]Includes recaptures.

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 18. Continued

Species	Standard Habitat Sites (SHS)									
	Pinyon-Juniper Hills TN = 592		Pinyon Juniper Sagebrush Hills TN = 399		Alkali Sacaton Annual Atriplex Swale TN = 590		Greasewood Alkali-Sacaton Drainage TN = 585		Ricegrass Snakeweed Dunes TN = 298	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	1	0.17	12	3.01			7	1.20		
Dipodomys ordii			14	3.51	5	0.85			2	0.67
Dipodomys spectabilis										
Eutamias quadrivittatus	12	2.03	14	3.51						
Neotoma albigula	7	1.18	1	0.25						
Neotoma cinerea	4	0.68								
Neotoma stephensi										
Onychomys leucogaster			1	0.25	3	0.51	2	0.34	1	0.34
Perognathus flavus	8	1.35	5	1.25	20	3.39	22	3.76	13	4.36
Perognathus flavescens			2	0.50						
Peromyscus crinitus	1	0.17								
Peromyscus maniculatus	33	5.57	8	2.01	16	2.71	21	3.59		
Peromyscus truei	30	5.07	11	2.76						
Reithrodontomys megalotis					2	0.34	32	5.47		
Spermophilus spilosoma			3	0.75	3	0.51	1	0.17	2	0.67
Spermophilus variegatus										
Total[1]	116	19.59	81	20.30	61	10.34	98	16.75	22	7.38

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN}$ X 100 (see page 70).

Table 18. Continued

Species	Special Features				Totals					
	Rock Outcrop TN = 297		Dry Lake Bed TN = 150		SHS Combined TN = 5436		Special Features Combined TN = 447		All Habitat Types TN = 5883	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	1	0.34	1	0.67	50	0.92	2	0.45	52	0.88
Dipodomys ordii	6	2.02			77	1.42	6	1.34	83	1.41
Dipodomys spectabilis					4	0.07			4	0.07
Eutamias quadrivittatus					26	0.48			26	0.44
Neotoma albigula					9	0.17			9	0.15
Neotoma cinerea	4	1.35			4	0.07	4	0.89	8	0.14
Neotoma stephensi										
Onychomys leucogaster	1	0.34			17	0.31	1	0.22	18	0.31
Perognathus flavus	1	0.34			115	2.12	1	0.22	116	1.97
Perognathus flavescens	8	2.69			9	0.17	8	1.79	17	0.29
Peromyscus crinitus					1	0.02			1	0.02
Peromyscus maniculatus	17	5.72	55	36.67	126	2.32	72	16.11	198	3.37
Peromyscus truei	8	2.69			42	0.77	8	1.79	50	0.85
Reithrodontomys megalotis	4	1.35			40	0.74	4	0.89	44	0.75
Spermophilus spilosoma					39	0.72			39	0.66
Spermophilus variegatus										
Total[1]	62	20.88	70	46.67	658	12.10	132	29.53	790	13.43

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN}$ X 100 (see page 70).

Table 19. Total trap nights (TN), total captures (TC)[1], and captures per unit effort (CE)[2] of small mammals during the entire sample period, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Sites (SHS)											
	Greasewood-Rabbitbrush Dunes TN = 1768		Snakeweed-Galletta Uplands TN = 1799		Mixed Shrub Rolling Uplands TN = 2953		Badlands TN = 2360		Sagebrush Galleta Rolling Uplands TN = 2373		Treated Sage TN = 598	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	20	1.13	3	0.17	21	0.71			8	0.34		
Dipodomys ordii	38	2.15	12	0.67	75	2.54			22	0.93	2	0.33
Dipodomys spectabilis			5	0.28	1	0.03			2	0.08		
Eutamias quadrivittatus												
Neotoma albigula							1	0.04				
Neotoma cinerea												
Neotoma stephensi												
Onychomys leucogaster	17	0.96	6	0.33	27	0.91			7	0.29		
Perognathus flavus	5	0.28	27	1.50	14	0.47	9	0.38	36	1.52	3	0.50
Perognathus flavescens	3	0.17	33	1.83	4	0.14			1	0.04		
Peromyscus crinitus												
Peromyscus maniculatus	22	1.24	15	0.83	38	1.29	71	3.01	56	2.36	7	1.17
Peromyscus truei	1	0.06										
Reithrodontomys megalotis	7	0.40	1	0.06	11	0.37	4	0.17				
Spermophilus spilosoma	29	1.64	1	0.06	46	1.56			1	0.04	2	0.33
Spermophilus variegatus												
Total[1]	164	9.28	57	3.17	262	8.87	99	4.19	171	7.21	15	2.51

[1]Includes recaptures.

[2]Captures per unit effort = $\frac{TC}{TN} \times 100$ (see page 70).

Table 19. Continued

Species	Standard Habitat Sites (SHS)									
	Pinyon-Juniper Hills TN = 2305		Pinyon Juniper Sagebrush Hills TN = 1698		Alkali Sacaton Annual Atriplex Swale TN = 2373		Greasewood Alkali-Sacaton Drainage TN = 2372		Ricegrass Snakeweed Dunes TN = 1192	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	2	0.09	22	1.30			10	0.42		
Dipodomys ordii			38	2.24	11	0.46			15	1.26
Dipodomys spectabilis										
Eutamias quadrivittatus	13	0.56	19	1.12						
Neotoma albigula	19	0.82	2	0.12						
Neotoma cinerea	8	0.35								
Neotoma stephensi										
Onychomys leucogaster			3	0.18	14	0.59	3	0.13	7	0.59
Perognathus flavus	8	0.35	6	0.35	38	1.60	34	1.43	24	2.01
Perognathus flavescens	2	0.12								
Peromyscus crinitus	5	0.22								
Peromyscus maniculatus	74	3.21	39	2.30	67	2.82	87	3.67	2	0.17
Peromyscus truei	148	6.42	45	2.65			1	0.04		
Reithrodontomys megalotis	2	0.09	1	0.06	2	0.08	56	2.36		
Spermophilus spilosoma			5	0.29	3	0.13	1	0.04	5	0.42
Spermophilus variegatus			1	0.06						
Total[1]	333	14.45	219	12.90	162	6.83	215	9.06	66	5.53

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN}$ X 100 (see page 70).

Table 19. Continued

Species	Special Features				Totals					
	Rock Outcrop TN = 1178		Dry Lake Bed TN = 577		SHS Combined TN = 21791		Special Features Combined TN = 1764		All Habitat Types TN = 23555	
	TC	CE	TC	CE	TC	CE	TC	CE	TC	CE
Ammospermophilus leucurus	7	0.59	2	0.35	86	0.39	9	0.51	95	0.40
Dipodomys ordii	12	1.01			213	0.98	12	0.68	225	0.96
Dipodomys spectabilis					8	0.04			8	0.03
Eutamias quadrivittatus					32	0.15			32	0.14
Neotoma albigula			1	0.17	22	0.10	1	0.06	23	0.10
Neotoma cinerea	4	0.34			8	0.04	4	0.23	12	0.05
Neotoma stephensi	4	0.34					4	0.23	4	0.02
Onychomys leucogaster	1	0.08			84	0.39	1	0.06	85	0.36
Perognathus flavus	10	0.84			204	0.94	10	0.57	214	0.91
Perognathus flavescens	11	0.93			43	0.20	11	0.62	54	0.23
Peromyscus crinitus					5	0.02			5	0.02
Peromyscus maniculatus	53	4.47	226	39.17	489	2.24	279	15.82	768	3.26
Peromyscus truei	16	1.35			194	0.89	16	0.91	210	0.89
Reithrodontomys megalotis	8	0.67			84	0.39	8	0.45	92	0.39
Spermophilus spilosoma	1	0.08			93	0.43	1	0.06	94	0.40
Spermophilus variegatus					1	0.01			1	0.004
Total[1]	157	13.23	577	45.23	1763	8.09	418	23.70	2181	9.26

[1]Includes recaptures

[2]Captures per unit effort = $\frac{TC}{TN}$ X 100 (see page 70).

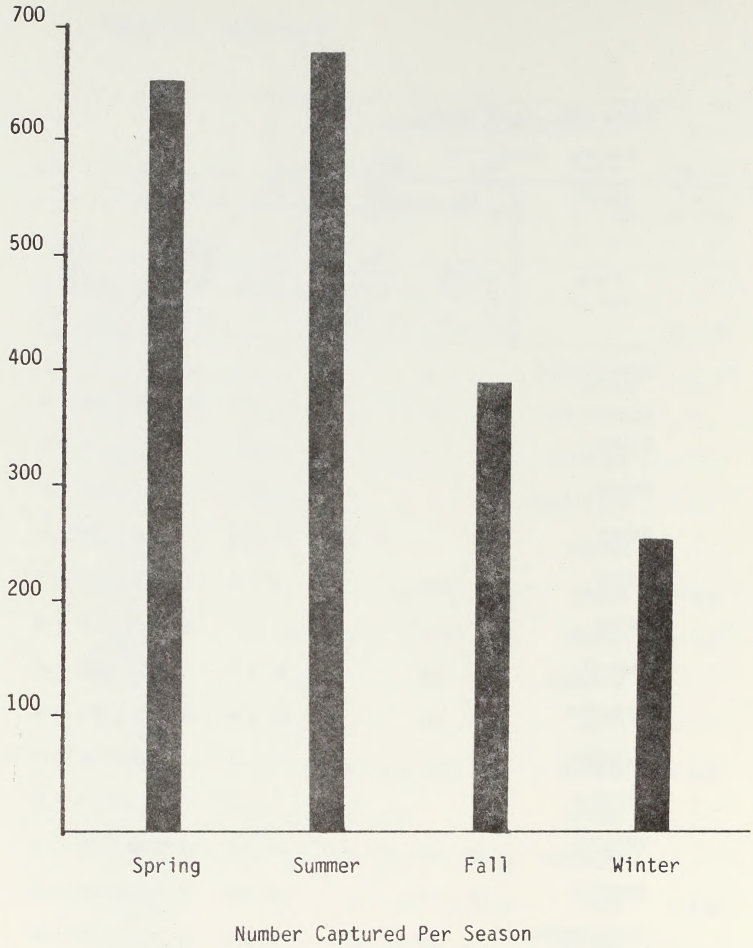

Figure 4. Number of small mammals captured per season, Chaco Strippable Coal Wildlife Study Area, New Mexico.

at the peak of rodent activity and population levels. Captures were lower in fall and lowest in winter when hibernation, weather conditions, predation, and other factors began to suppress activity levels and population numbers. Figure 4 graphically displays the number of captures per season.

The sex ratios (Tables 10 through 14) of captured animals overall favored adult males. A 50:50 sex ratio would have inferred a 1:1 litter sex structure, equal mortality rates with age, and an equal capture probability (MacMahon 1975). Such ideal conditions do not exist in most natural ecosystems. Age affects trappability because of the animals' prior experience and social rank. Older animals frequently rank higher in social stature and may be caught first and more often than young individuals (Carley and Knowlton 1968, Gentry et al. 1968, Andrzejewski and Rajska 1972, Summerlin and Wolfe 1973). In addition, males traverse larger areas than females, thereby increasing the probability of encountering a trap (Howard 1960, Brown 1969).

The deer mouse (Peromyscus maniculatus) was the most abundant rodent captured during every sample period. This species represented 58% of the captures in the fall, 56% in winter, 34% in spring, 30% in summer and 40% overall. Further discussion of the ubiquity of the deer mouse is presented in the section on habitat preferences. The next three species with the highest number of captures were, in descending order, Ord's kangaroo rat (Dipodomys ordii), silky pocket mouse (Perognathus flavus), and pinyon mouse (Peromyscus truei), with 225 (12%), 215 (11%), and 210 (11%) captures, respectively. The least frequently captured

species was the rock squirrel (Spermophilus variegatus) with one individual trapped during the entire study. Some of the species such as the spotted ground squirrel and Colorado chipmunk hibernate which would explain why they were trapped only during the spring and summer seasons. All of the other species of small mammals are active throughout the year but some, such as the banner-tailed kangaroo rat, white-throated and bushy-tailed woodrat, plains pocket mouse, canyon mouse (Peromyscus crinitus), and the rock squirrel, were captured only during certain seasons. The interaction of many factors, of course, are involved in explaining this phenomenon and a lengthy discussion will not be presented; however, two elements which are most likely are weather and the differential trappability of certain species. The interested reader is referred to Smith et al. (1975) for further discussion of behavioral responses of small mammals to traps and trapping. In the case of the banner-tailed kangaroo rat, the low trap success is probably because of their habitual travel along runways (Rosenzweig and Winakur 1969) which were easily missed during trapping. Fitch (1954) states that marked changes in trapping success probably are more often caused by change in bait acceptance than by change in actual population densities.

Some species appeared to be quite general in their preference of habitats. The three species which had the most individuals captured, Ord's kangaroo rat, silky pocket mouse, and deer mouse, were also found in most SHS's. In fact, the deer mouse was captured in every SHS and the two special habitat features sampled. Some species, such as the white-tailed antelope squirrel, had a relatively low number of captures

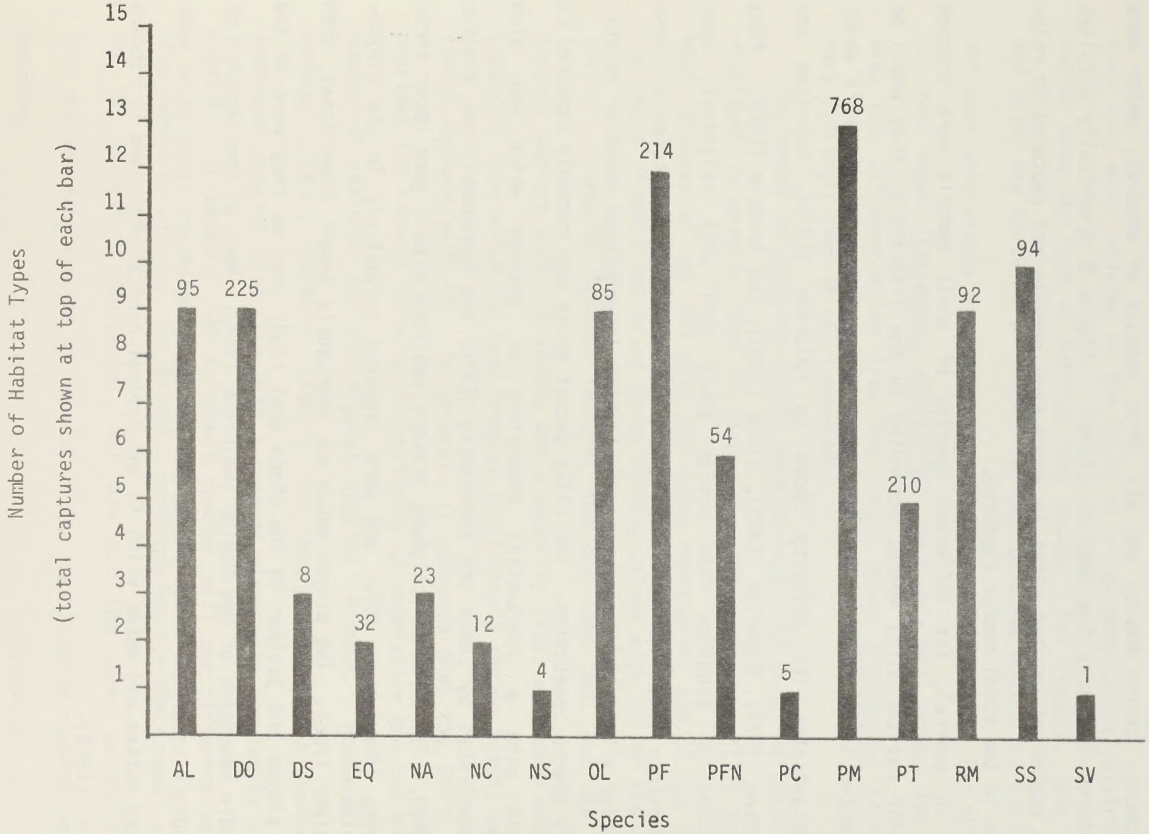

Figure 5. Number of habitat sites in which each species was captured, Chaco Strippable Coal Wildlife Study Area, New Mexico.

AL - Ammospermophilus leucurus
DO - Dipodomys ordii
DS - Dipodomys spectabilis
EQ - Eutamius quadrivitattus
NA - Neotoma albigula
NC - Neotoma cinerea
NS - Neotoma stephensi
OL - Onychomys leucogaster
PF - Perognathus flavus
PFN - Perognathus flavescens
PC - Peromyscus crinitus
PM - Peromyscus maniculatus
PT - Peromyscus truei
RM - Reithrodontomys megalot
SS - Spermophilus spilosoma
SV - Spermophilus variegatus

but was found in 9 of the 13 habitat sites sampled. On the other hand, captures of the pinyon mouse totaled 210 within only 5 of the 13 habitat sites. There are a few highly specialized species, such as the Colorado chipmunk, canyon mouse, and all three species of woodrat, which were captured in very few habitat sites. Figure 5 graphically displays the number of habitat sites in which each species was captured in relation to the total number captured.

In general, the different species of small mammals were trapped within habitat sites where, according to the literature, they would be expected to be found. The deer mouse was captured in all SHS's which substantiates its ubiquity shown by Holbrook (1978), Larrison and Johnson (1973), Reynolds (1980), Albee (1980), and Arnette (1979). Many species of kangaroo rats prefer sandy soil with relatively open understory vegetation (Rosenzweig and Winakur 1969). Captures of these species within the study area were highest in vegetated dunes of relatively sparse vegetation. The silky pocket mouse was commonly captured in areas with a substantial understory of grasses which was also demonstrated by Lemen and Rosenzweig (1978) and Rosenzweig and Winakur (1969). The Colorado chipmunk prefers habitats with a good upper shrub canopy (Montgomery 1976) and were captured exclusively in the pinyon-juniper types. The pinyon mouse was frequently caught under trees, such as pinyon and juniper in the Chaco Coal study area as they were in the Sandia Mountains of New Mexico (Holbrook 1978). Most of the captures of woodrats occurred in the pinyon-juniper types which are found on or near rocky buttes and mesas which is the typical habitat described by Findley et al (1975).

Some of the species of small mammals listed in the hypothetical species list were included on the basis of gross geographical distribution rather than the type of habitat they occupy. For example, some shrews and voles may be shown to inhabit northwestern New Mexico but habitat is not available within the study area (Findley et al. 1975). One species, the rock mouse (Peromyscus difficilus), may very well occupy the study area but differentiation from the pinyon mouse (Peromyscus truei) is very difficult even in the laboratory.

The number of captures within each habitat site shown on Table 14 is displayed in graphic form in Figure 6. Pinyon-juniper hills had the most captures of any SHS with 280 which represented 15% of the total. The second highest was mixed shrub rolling upland with 237 or 12% of the total. A special habitat feature, the dry lake bed, had the third highest capture with 229 (12%), but a majority (99%) were deer mice. A sagebrush type which had been treated to eliminate shrubs (1956) had the lowest capture with 14. In general, it appeared that the SHS's which provided the highest structural complexity of vegetation had the highest number of captures and the highest species richness. Rozensweig and Winakur (1969), Holbrook (1978), and Montgomery (1976) correlated increased species diversity with increased structural complexity of the habitat. It appears that different species will use different vegetation layers or strata. For example, some species use the ground, others use the understory vegetation, and some use the upper canopy layer. This enables many species to coexist in the more complex vegetation communities.

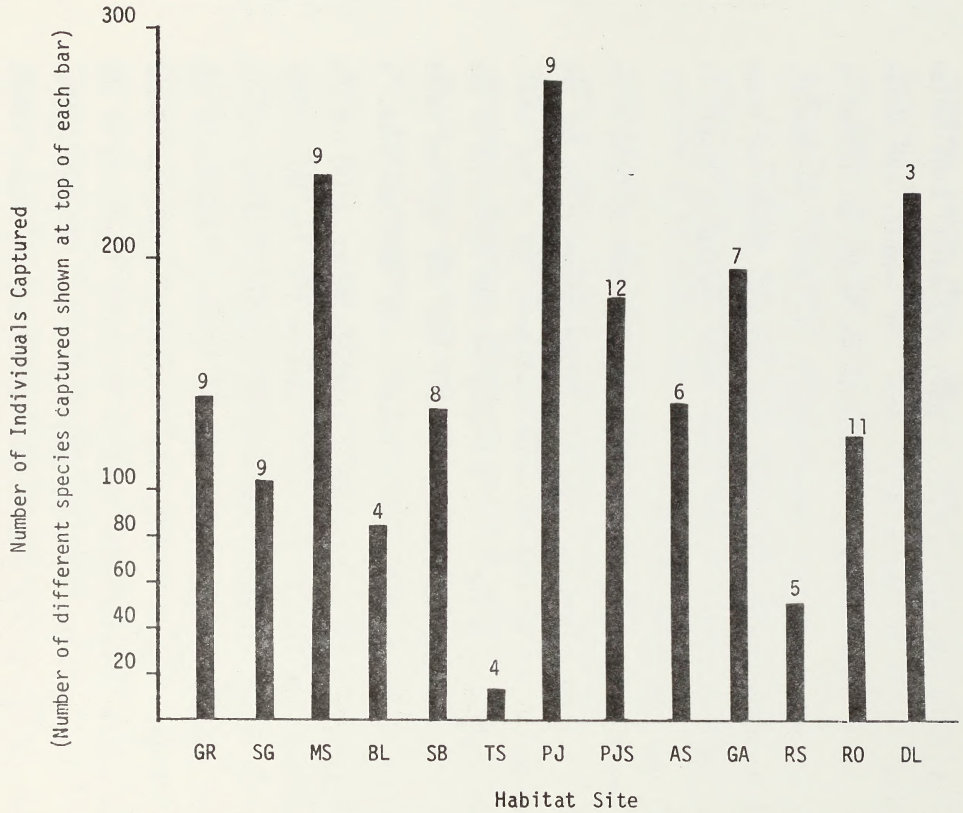

Figure 6. The number of small mammal captures within each habitat site, Chaco Strippable Coal Wildlife Study Area, New Mexico.

GR - Greasewood/Rabbitbrush Dunes
SG - Snakeweed/Galleta Uplands
MS - Mixed Shrub Rolling Upland
BL - Badlands
SB - Big Sagebrush/Galleta Rolling Uplands
TS - Treated Sagebrush
PJ - Pinyon-Juniper Hills
PJS - Pinyon-Juniper/Sagebrush Hills
AS - Alkali Sacaton/Annual Atriplex Swale
GA - Greasewood/Alkali Sacaton Dra
RS - Ricegrass/Snakeweed Dunes
RO - Ricegrass/Snakeweed
DL - Dry Lakebed

The species diversity within each habitat site is shown in Table 20. The general trends in number of captures per habitat site and seasonal captures discussed earlier (Tables 10 through 19) are also seen in species diversity. Figures 7 and 8 show a comparison of the general trends in species diversity, species richness, and total captures between habitat sites and between seasons. The diversity in summer is highest, as would be expected and winter the lowest. Pinyon-juniper hills and pinyon-juniper sagebrush hills had a large number of captures, high species richness, and high species diversity. The dry lake bed had a large number of captures, however, species richness and diversity were low as would be expected in this area of low vegetational complexity. Using species richness, species diversity, and total captures, it appears that, as discussed earlier, the habitat sites with the highest structural complexity of vegetation are the most important for small mammals.

There were a total of 11 captures of the pocket gopher, all of which were Botta's (Thomomys bottae). The low capture success did not indicate the distribution of pocket gophers within the study area. Sign, however, in the form of fresh soil mounds, showed that the gophers are well distributed everywhere except the badlands. This is expected since sandy soil predominates in the area and is preferred by the gophers (Miller 1953).

Throughout the year an attempt was made to add to the small mammal species list by the use of cans or buckets buried level with the ground surface. These cans were used in conjunction with a drift fence to funnel animals toward the traps. Findley et al. (1975) suggests that the

Table 20. Small mammal species diversity, by season, within each standard habitat site and two special habitat features, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Habitat Type	Fall	Winter	Spring	Summer	Yearly Average
Greasewood/Rabbitbrush Dunes	1.49	0.66	1.64	2.11	1.48
Snakeweed/Galleta Uplands	0	0.78	1.49	1.12	0.85
Mixed Shrub Rolling Uplands	0.81	0.95	1.77	1.84	1.34
Badlands	0.43	0	0.41	1.1	0.48
Sagebrush/Galleta Rolling Uplands	0.99	0.53	1.07	1.30	0.98
Treated Sage[1]	0.72	1.0	1.0	1.52	1.06
Pinyon-Juniper Hills	0.87	1.06	1.45	2.29	1.41
Pinyon-Juniper/Sagebrush Hills	1.48	1.41	2.27	2.42	1.89
Alkali Sacaton/Annual Atriplex Swale	0.39	0.57	1.25	1.49	0.92
Greasewood/Alkali Sacaton Drainage	0.38	0.67	0.99	1.58	0.90
Ricegrass/Snakeweed Dunes[1]	1.1	0.89	1.86	1.26	1.28
Rock Outcrop	2.87	0.82	1.92	1.93	1.89
Dry Lake Bed	0	0	0.32	1.31	0.11
Seasonal $\bar{x}$	0.87	0.72	1.34	1.64	

[1]The high species diversity in this type is probably meaningless because of a small sample size.

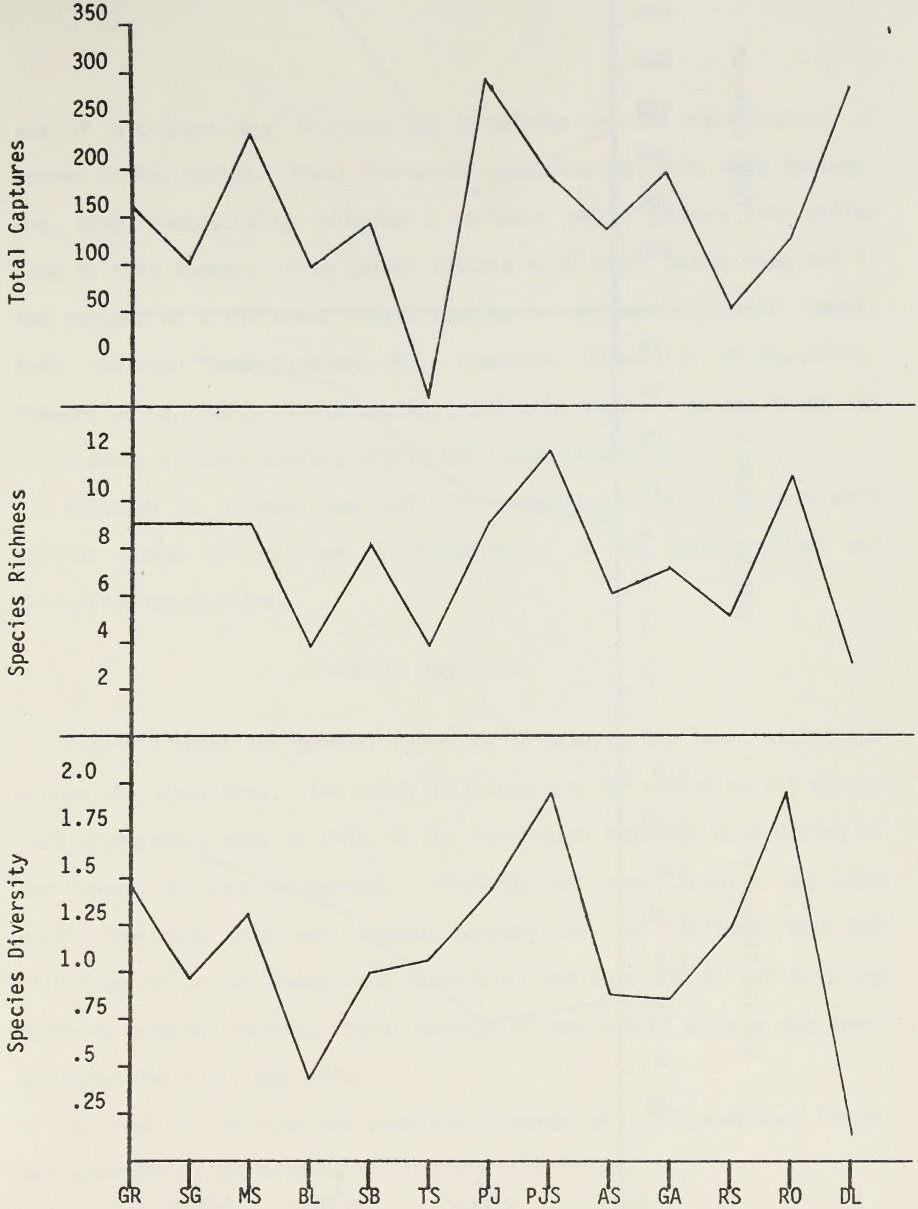

Figure 7. Comparison of species diversity, species richness, and total captures between standard habitat sites, Chaco Strippable Coal Wildlife Study Area, New Mexico.

GR - Greasewood/Rabbitbrush Dunes
SG - Snakeweed/Galleta Uplands
MS - Mixed Shrub Rolling Uplands
BL - Badlands
SB - Big Sagebrush/Galleta Rolling Uplands
TS - Treated Sagebrush
PJ - Pinyon-Juniper Hills
PJS - Pinyon-Juniper/Sagebrush Hills
AS - Alkali Sacaton/Annual Atriplex Swale
GA - Greasewood/Alkali Sacaton Drainage
RS - Ricegrass/Snakeweed Dunes
RO - Rock Outcrops
DL - Dry Lakebed

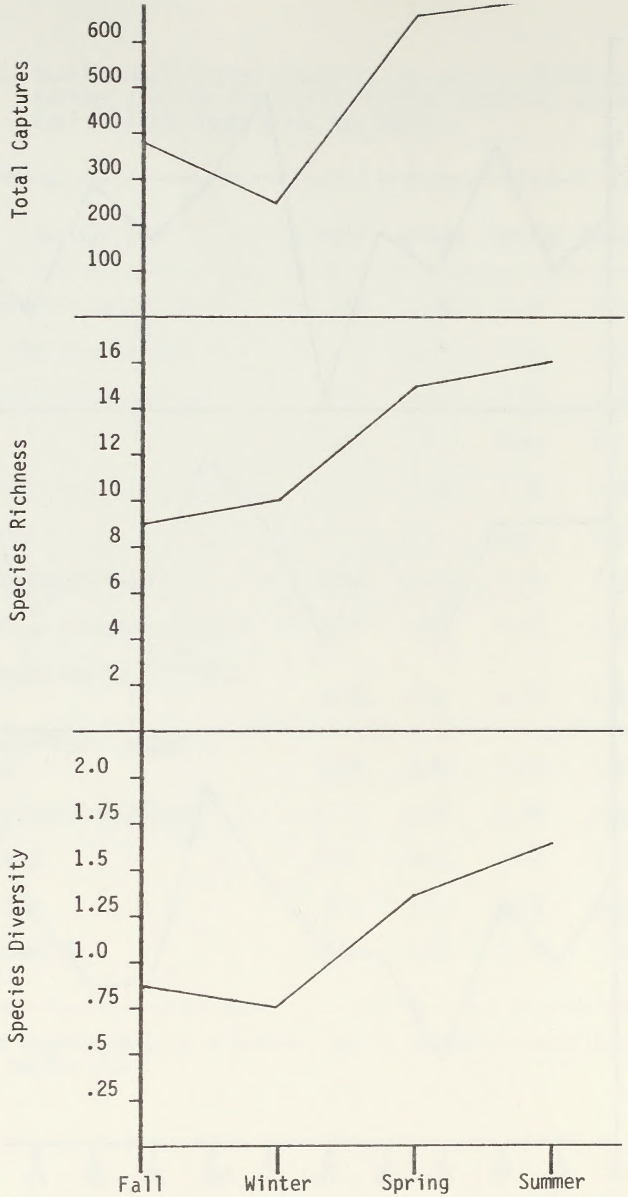

Figure 8. Comparison of species diversity, species richness, and total captures between seasons, Chaco Strippable Coal Wildlife Study Area, New Mexico.

use of pit-traps may increase our knowledge of the distribution of shrews in New Mexico. Fratt (Personal communication, BLM, Rock Springs, Wyo. 1979) successfully collected 2 northern pocket gophers with coffee cans in this manner. Five gallon buckets with drift fences resulted in the capture of 9 different rodent species in northern Wisconsin (Dennis Kent, personal communication, M.S. research, University of Wisconsin, Stevens Point, 1980). Unfortunately, 101 trap nights with pit-traps did not produce a single capture within the Chaco study area.

Although an attempt was made to correlate trapping success with various phases of the moon, inconsistencies in the data preclude any definitive conclusions.

Prairie Dog Survey

Figure 9 shows the general locations of prairie dog towns within and around the study area. The exact locations are delineated on 7.5 minute USGS topographic maps on file in the Farmington Resource Area Office of the Bureau of Land Management. Probably not every prairie dog town within the study area was located; however, we feel confident that 95% of the major active towns were identified and that 90% of all existing colonies were delineated. Total acreage of the active prairie dog towns was approximately 1,600 acres.

No sign to indicate the possible presence of a black-footed ferret was observed on any colony.

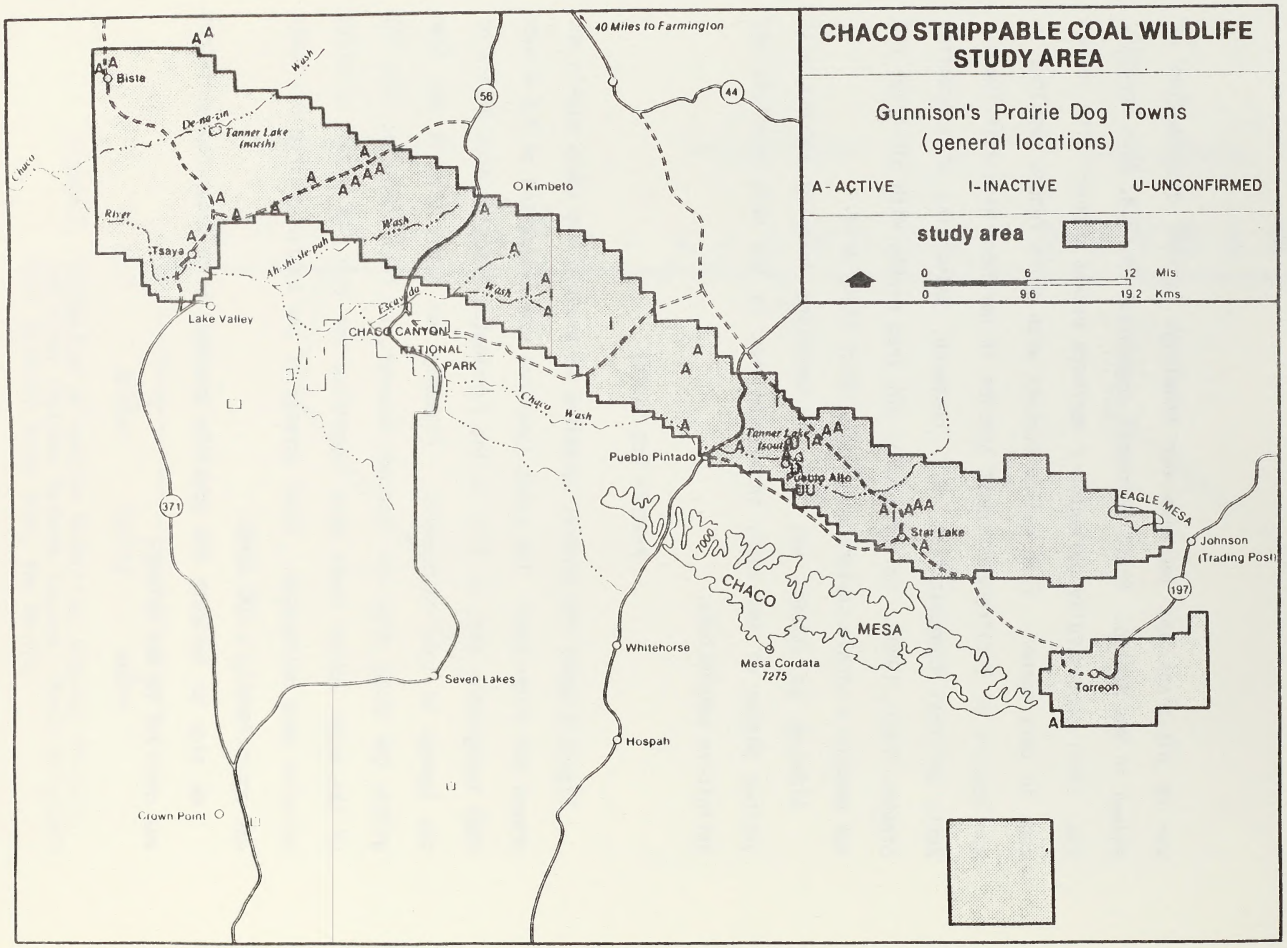
CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
Gunnison's Prairie Dog Towns (general locations)
A-ACTIVE
I-INACTIVE
U-UNCONFIRMED
study area
0 6 12 Mls
0 9.6 19.2 Kms
40 Miles to Farmington
Bista
Tanner Lake (north)
Tsaya
Lake Valley
Kimbeto
CHACO CANYON NATIONAL PARK
Pueblo Pintado
Pueblo Alto
Star Lake
EAGLE MESA
Johnson (Trading Post)
Torreon
CHACO MESA
Mesa Cordata 7275
Whitehorse
Hospah
Seven Lakes
Crown Point
Chaco River
Chaco Wash
Escavada Wash
Ah-shi-sle-pah Wash
De-na-zin Wash
Tanner Lake (south)
56
44
371
197
7000

Figure 9

Carnivores

Two primary methods of determining carnivore status, scent posts and night drives, produced surprisingly little results. These methods, combined with incidental sightings, provide a skeleton of carnivore occurrence on the study area.

Scent Posts

In the fall of 1980, a 14.7 mile long transect of scent posts was established in accordance with guidelines of the Predator Control Unit of the U.S. Fish and Wildlife Service. Of 85 scent post nights, 15 visits by coyote or dog were reported. The deep sand of the study area allows easy sifting and preparation of the scent stations, but also yields indistinct tracks (Roughton 1979). With this in mind, we did not attempt to separate the tracks of the two large canids. In addition, domestic dogs are quite common and concentrate around scent posts resulting in obliteration of any wildlife tracks.

Because of the lack of distinct tracks, weather invalidation of one-half of the scent-post nights, and the great deal of time required to maintain the scent-post transect, this method was abandoned in favor of disperse scent posts placed near mammal trapping grids in appropriate habitat. A total of 168 scent-post nights resulted in 13 coyote or dog visits, 11 kit fox, and 3 red fox visits. Over half (7) of the large canid tracks were observed in greasewood-alkali sacaton drainages,

whereas kit fox sign was most common in mixed shrub rolling uplands (4) and along the rim of badlands (3). One visit of red fox was noted in 3 different habitats: mixed shrub rolling upland, alkali sacaton-annual atriplex swale, and a rock outcrop.

Night Drives

Night driving for a total of 14 hours and 20 minutes on 12 different nights for a distance of almost 450 miles resulted in 3 observations of kit fox, 1 coyote, and 1 red fox. Observations of these secretive carnivores may be increased through the use of infra-red spotlights or large aircraft-type landing lights. Problems with nighttime surveys will continue in the Chaco area due to distrust by the local residents and their fear of livestock poaching. During one night drive our crew was stopped, told to cease spotlighting, and escorted back to Chaco Canyon National Park.

Incidental Sightings

During the course of the field season, incidental sightings of carnivores were recorded on BLM Wildlife Observation Sheets (BLM Form 6610-2) One kit fox den was noted and 375 scats were collected near badlands north of Black Lake. Red fox were positively identified on 3 separate occasions, all near the beginning of June. Only one badger was observed during the entire year, but possible diggings were noted on 5 different occasions. One bobcat was nearly hit by our truck as it

sprinted across the road near the Chaco Canyon visitor center. Buried scat of a bobcat was found on Chaco Mesa, and many tracks were identified in both snow and sand. During the winter sample, cougar tracks were followed in the snow along a rim of Chaco Mesa, and in spring several prints were found perfectly cast in mud. A careful search for denning sites was conducted in summer by Bruce Ackerman, but none were found. It is presumed that this cat is an occasional wanderer through the mesa rather than a resident. Coyotes were, by far, the most commonly observed carnivores on the study area, with 29 separate sightings throughout the year in a wide variety of habitats.

Skunks

Two species of skunks were expected on the study area--the western spotted and the striped skunk. No tracks could be identified at any of the scent posts, and night drives did not produce sightings as expected. Residents of the Star Lake pumping station reported visits by 2 striped skunks in recent years, and one barely distinguishable roadkill was found near the Tinian Mission along the pipeline road. Erica Craig reported seeing one, possibly two striped skunks near Transect Bt-27. Striped skunks are known for their fondness for human habitations (Findley et al. 1975) and our knowledge of the species could probably be expanded through questionnaires and increased trapping efforts in populated areas.

Driving Surveys and Mammal Data From Avian Survey

Tables 21 and 22 present a summary of lagomorph sightings from the avian survey (hereafter referred to as flushing transects) and driving survey, respectively. It is interesting to note that both types of surveys resulted in the same general trends in the data, although the flushing transects provide a much larger sample size. As will be discussed later, we were surprised at the low number of observations from the driving surveys.

It appears that both the black-tailed jackrabbit and cottontail prefer the sagebrush and greasewood communities. The cottontail, however, preferred the pinyon-juniper sagebrush mixture over the pure sagebrush. Also, the cottontail had an affinity for the pinyon-juniper hills which has poorer quality understory vegetational cover than the shrub types. Only 3 jackrabbits were observed in this type during the entire year.

The fewest rabbits were counted in the winter sampling period. Little difference in numbers was observed on the flushing transects during the spring and summer whereas the majority of observations from the driving survey occurred in the summer. This is most likely a result of seasonal distribution patterns. The flushing transects provided a much broader coverage of the study area whereas the driving surveys were restricted to roads and probably bypassed areas where rabbits concentrate during winter.

Table 21. Summary of desert cottontail and black-tailed jackrabbit sightings from bird survey transects, Chaco Strippable Coal Wildlife Study Area, New Mexico.

	Winter		Spring		Summer		Fall		Total	
Standard Habitat Site	CT[1]	JR[2]	CT	JR	CT	JR	CT	JR	CT	JR
Greasewood/rabbitbrush dunes		5	5	12	3	16	5	16	13	49
Pinyon-juniper hills	2		13		14		13	3	42	3
Sagebrush/galleta rolling uplands			1	4	1	13	2	7	4	34
Greasewood/alkali sacaton drainage	2		6	8	13	9	10	3	31	20
Pinyon-juniper/sagebrush Hills	8	3	10	9	9	12	2	3	29	27
Mixed shrub rolling upland		7	1	4	1	2		1	2	14
Ricegrass/snakeweed dunes	2		3	1	1				6	1
Alkali sacaton/annual atriplex swale				4			1	1	1	5
Snakeweed/galleta uplands				1	2	1			2	2
Badlands										
Total	14	15	39	53	44	53	33	34	130	155

[1]CT - Desert cottontail

[2]JR - Black-tailed jackrabbit

Table 22. Summary of lagomorph observations from driving/spotlighting surveys, Chaco Strippable Coal Wildlife Study Area, New Mexico.

	Sagebrush		Pinyon-Juniper/ Sagebrush		Alkali Sacaton/ Atriplex Swale		Mixed Shrub		Total	
	CT[1]	JR[2]	CT	JR	CT	JR	CT	JR	CT	JR
Fall	2	6		4					2	10
Winter	3	5							3	5
Spring		10								10
Summer	3	42			1	3	1	6	5	51

[1]CT - Desert cottontail

[2]JR - Black-tailed jackrabbit

Figures 10 and 11 illustrate the numbers of jackrabbits and cottontail observations both seasonally and by standard habitat site recorded on the flushing transects.

The low number of rabbit observations during our driving surveys is contradictory to the findings of a study in eastern Wyoming (Arnette 1979). Our driving survey averaged 0.25 lagomorph observations per mile whereas Arnette's averaged 14.2 observations per mile. In fact, Arnette (Personal communication) did not establish flushing transects (which would be comparable to our avian survey transects) because he felt, as dictated by past experience, that they would not provide adequate results.

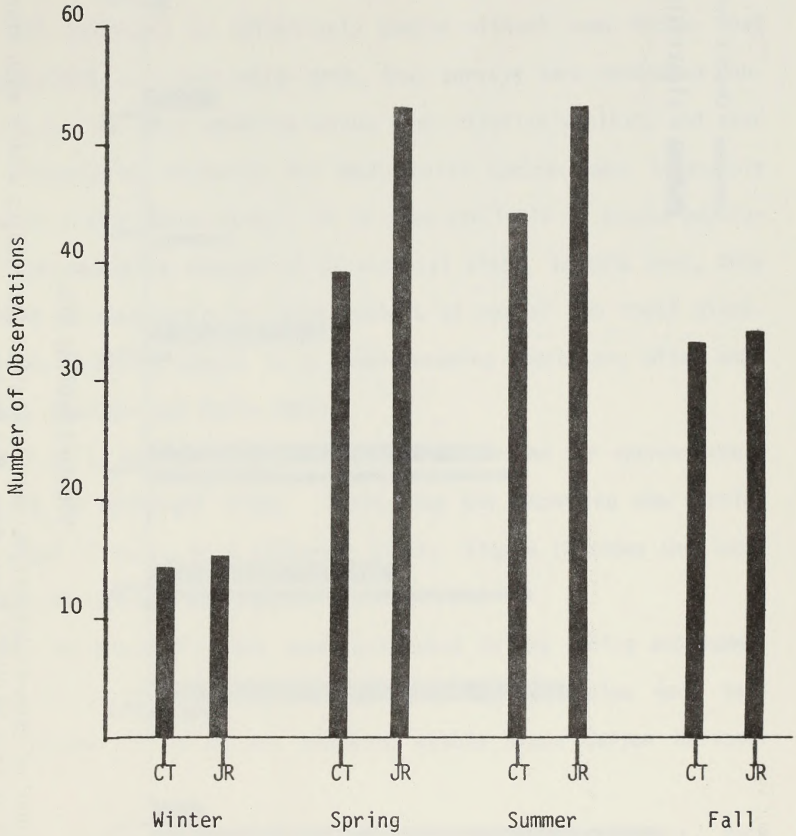

Figure 10. Seasonal observations of desert cottontail (CT) and black-tailed jackrabbit (JR), Chaco Strippable Coal Wildlife Study Area, New Mexico.

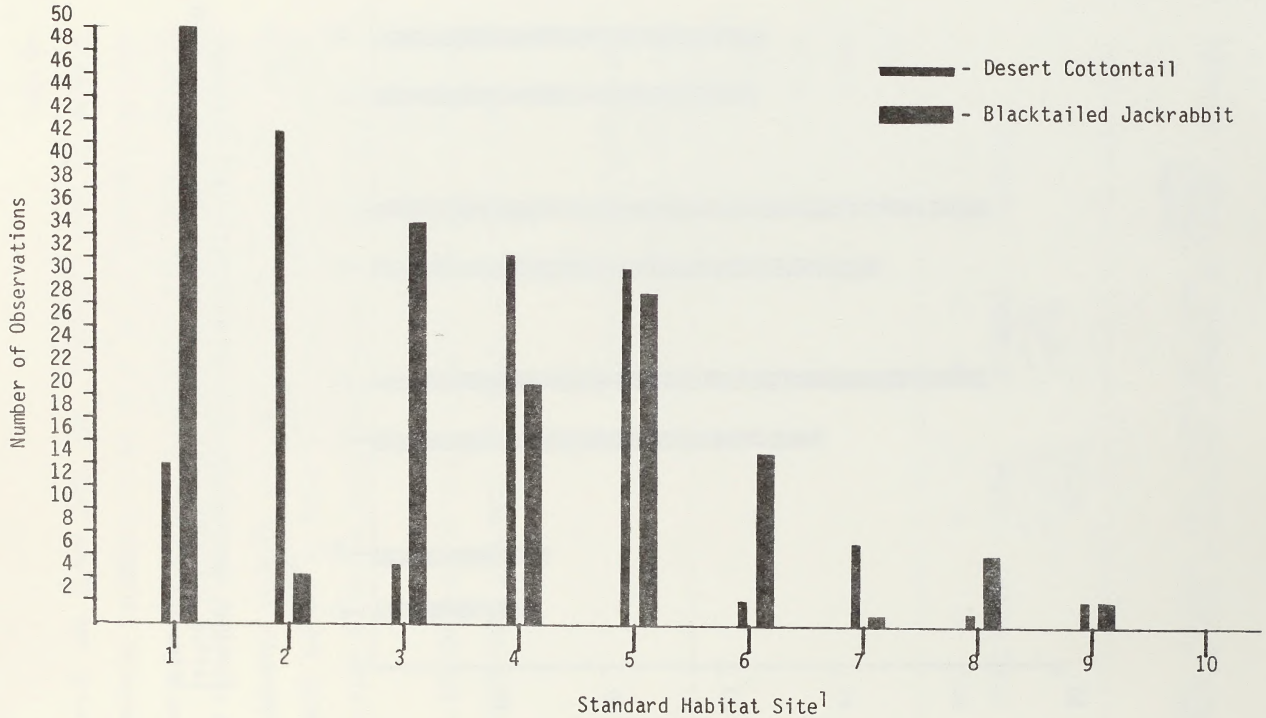

Figure 11. Number of observations of desert cottontails and blacktailed jackrabbits within each standard habitat site, Chaco Strippable Coal Wildlife Study Area, New Mexico.

[1]1 - Greasewood/rabbitbrush dunes;
2 - Pinyon-juniper hills;
3 - Sagebrush/galleta rolling uplands;
4 - Greasewood/alkali sacaton drainage;
5 - Pinyon-juniper/sagebrush hills;
6 - Mixed shrub rolling upland;
7 - Ricegrass/snakeweed dunes;
8 - Alkali sacaton/annual atriplex swale;
9 - Snakeweed/galleta uplands;
10 - Badlands

Bat Survey

Bats are difficult to effectively sample without some factor that concentrates them in a particular area, thus surveys were conducted non-randomly, e.g., at stock watering ponds, over riparian habitat, and near rimrock. Population estimates for noncolonial species were impossible to obtain in a short term study. It is also difficult to assess populations of bats normally thought of as colonial since, in this area, they do not tend to congregate in large numbers at one or two roost sites. In addition, locating roosts is a time-consuming operation, often with low success (Barbour and Davis 1969).

A total of 12 mist netting sessions were conducted for approximately 40 hours at 14 different sites. Monitoring and recording was carried out for about 10 hours at 6 different sites. Figure 12 shows the locations where the surveys took place.

Efforts to obtain bat data were restricted to the spring and summer samples. At no time during the fall or winter samples were bats detected, except on occasional sighting within Chaco Canyon National Park.

Habitats sampled were washes with standing pools, canyons, rock outcrops, stock ponds, and one bridge. One monitoring session was conducted around the flood lights at Star Lake Pump Station. Table 23 summarizes the bat survey results.

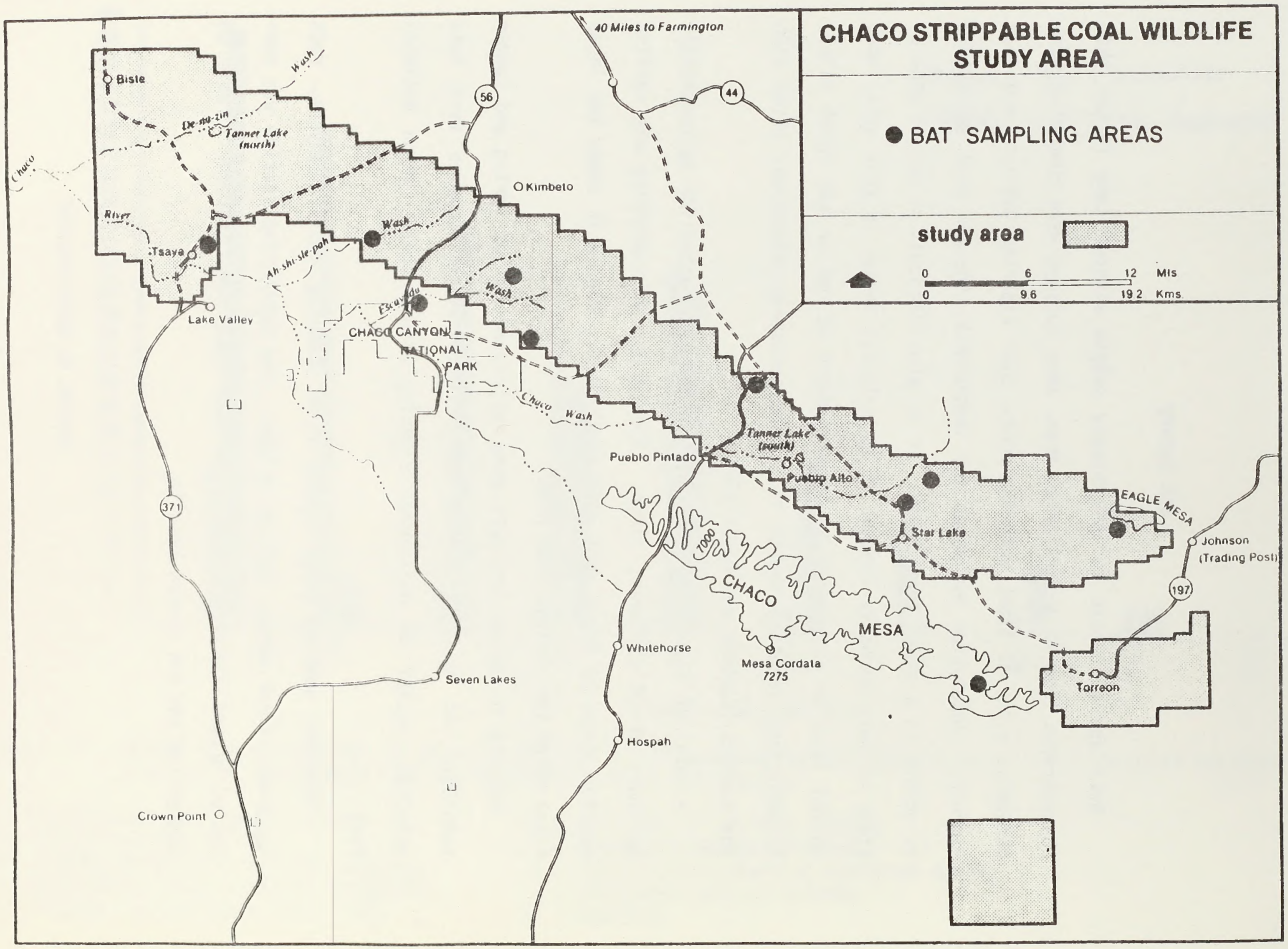
CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
BAT SAMPLING AREAS
study area
0 6 12 Mls
0 9.6 19.2 Kms
40 Miles to Farmington
Biste
Tanner Lake (north)
Tsaya
Lake Valley
Kimbeto
CHACO CANYON NATIONAL PARK
Pueblo Pintado
Tanner Lake (south)
Pueblo Alto
Star Lake
EAGLE MESA
Johnson (Trading Post)
CHACO MESA
Mesa Cordata 7275
Torreon
Whitehorse
Seven Lakes
Hospah
Crown Point
56
44
371
197

Figure 12

Table 23. Summary of bat captures, Chaco Strippable Coal Wildlife Study Area, New Mexico.

General Location	Species	Date of Capture	Male	Female	Unknown	Habitat
Gallo Wash	Yuma Myotis	7/17/81	1			Stock water pond
Chaco Mesa	Silver-haired Bat	4/30/81	1			Rocky rim of mesa
Tsaya Canyon	Western Pipistrel	7/23/81			2	Cliff
Tsaya Canyon	Pallid Bat	7/18/81		1		Canyon Rim
Tsaya Canyon	Townsend's Big-eared Bat	7/15/81			1[1]	Spring

[1]Incidental, carcass found.

No large concentrations of bats were found on the project area. The largest group was observed in Tsaya Canyon with approximately 10 individuals.

It was anticipated that keys to the identification of bats through vocalizations would be available prior to completion of this study; however, they are not, as yet, available. In addition, mist netting success was extremely low and therefore we were unable to correlate vocalizations with species for identification purposes. There are undoubtedly several species of bats recorded on the monitor that were not captured in the mist nets.

It is suggested that bats do not occur on the study area in large numbers. They would have to be sampled much more intensively for several years for complete species occurrence information.

Species of bats which were not captured but have been observed in the vicinity of the study area are long-legged myotis (*Myotis volans*), California myotis (*Myotis californicus*), small-footed myotis (*Myotis subulatus* also known as *M. leibei*) and big brown bat (*Eptesicus fuscus*). Occurrence records of these species were obtained from Chaco Canyon National Park and the Museum of Southwestern Biology, UNM, New Mexico.

Summary of Mammal Survey

1. A total of 23,555 trap nights were completed on 40 sample sites within 11 SHS's and 2 special habitat features.

2. A total of 19 species of rodents were identified, the most abundant species being the deer mouse, pinyon mouse, silky pocket mouse, and Ord's kangaroo rat. The least common was the rock squirrel.
3. The SHS with the highest structural complexity of understory vegetation and canopy cover appeared to support the highest populations, the largest numbers of different species, and have the highest diversity index. The most important SHS's were pinyon-juniper/sagebrush hills, pinyon-juniper hills, greasewood/rabbitbrush dunes, and greasewood/alkali sacaton drainage.
4. A total of 168 scent-post nights resulted in 13 coyote or dog visits, 11 kit fox visits, and 3 red fox visits. About 450 miles of spotlighted night driving resulted in 3 kit fox, 1 coyote, and 1 red fox observation.
5. Driving surveys and flushing counts from avian transects resulted in 130 desert cottontail observations and 155 black-tailed jackrabbit sightings. Pinyon-juniper hills was most used by the cottontail and greasewood/rabbitbrush dunes by the jackrabbit.
6. Only 5 species of bats were identified from 40 hours of mist netting in 12 sessions at 14 different locations.
7. The 34 mammal species identified within the study area represent 38% of the mammal species shown in Task 1, Hypothetical Species List.

AVIAN SURVEY

Introduction

Birds comprise the most diverse class of vertebrates inhabiting the Chaco Strippable Coal Wildlife Study Area. A survey was conducted from November 1980 through July 1981 to census the species occurring on the site and to define year-round habitat utilization. Songbirds were inventoried in all standard habitat sites in addition to separate assessments of raptors.

A total of 5 sampling sessions of 10 to 22 days were conducted between November 1980 and July 1981. The majority of the information used concerning the avian communities of the study area comes from these sessions. Additional information was obtained from the literature and other portions of the BIO/WEST vertebrate inventory.

Literature Review

Although detailed studies of the bird communities in northwestern New Mexico are limited, several studies dealing with birds of the Southwestern U.S. are relevant (Bailey 1928; Ligon 1961; and Hayward 1967). Early studies (Bailey 1928) focused on the natural history of the birds of New Mexico. More recently, ornithologists have been studying the habitat requirements of guilds and individual species (Ligon 1961; Tolle 1977; Weins 1973). Whereas some species are strongly

associated with a certain habitat type, e.g., pinyon jays and plain titmice occupy pinyon-juniper woodlands (Ligon 1978), other species are more ubiquitous, e.g., horned larks and mourning doves (Ligon 1961). This trend of research is directly applicable as it provides resource managers with the information necessary to evaluate land use alternatives.

Important game birds in New Mexico include the mourning dove, which is often a year-round resident (BLM 1978), and the scaled quail (Russell 1932). Recent studies concerning game birds and their habitat requirements include Campbell (1976) on foreign game birds in New Mexico, Braun et al. (1975) on band-tailed pigeons and Goodwin and Hungerford (1977) on quail.

Increased development and industrialization in northwestern New Mexico has spurred concern about the effects these changes might have on wildlife. Riparian areas are of special interest since they provide habitat for a diverse avifauna as well as critical refuge for migrating waterfowl in New Mexico (Hayward 1967; Schmitt 1973).

Methods

Song Bird Survey

Transect lines were established within each of ten standard habitat sites on the study area. Figure 13 shows the general locations of the transect lines and Table 24 lists the transect numbers and the standard habitat site in which they were located. Maps showing locations are

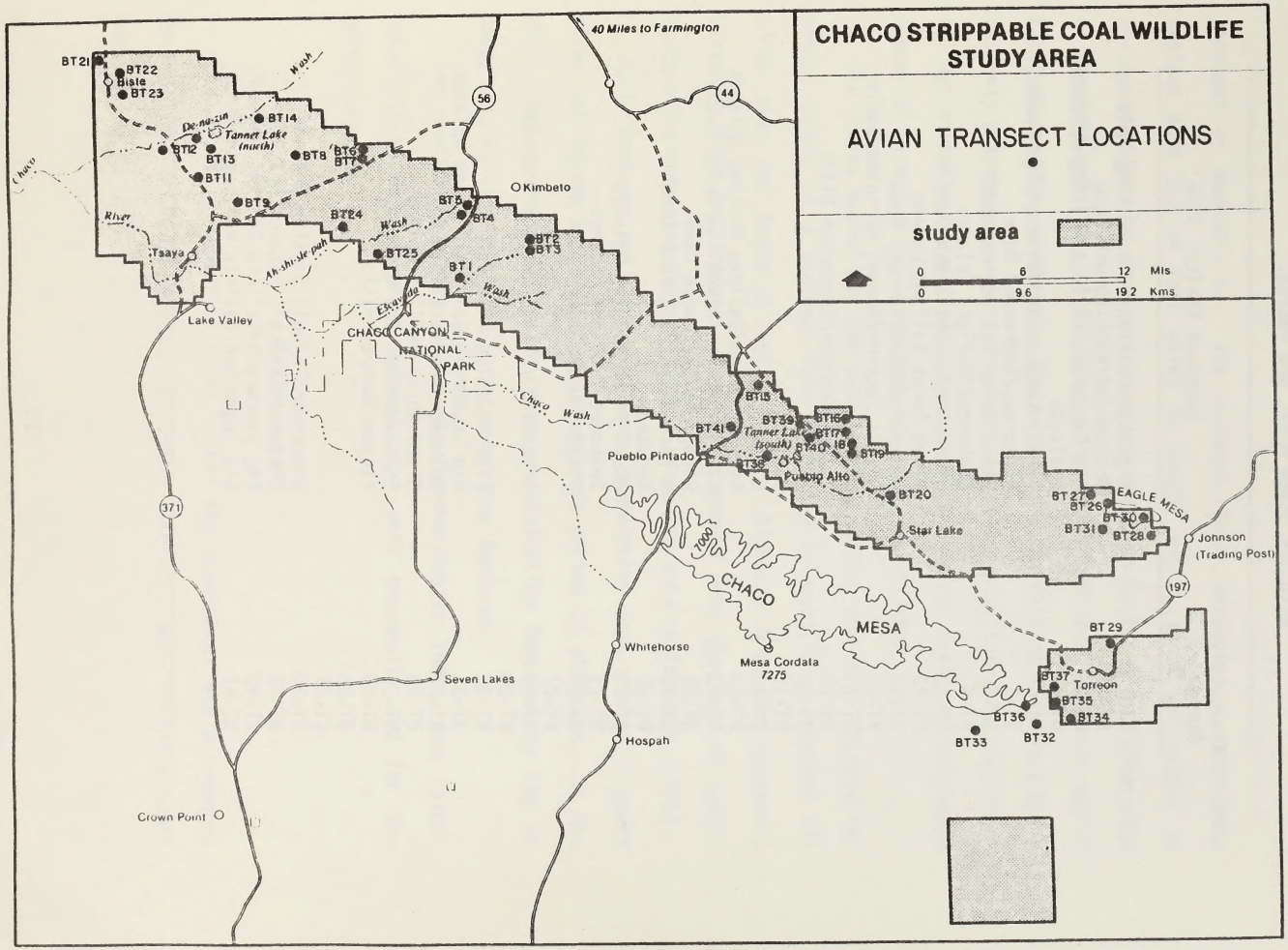
CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
AVIAN TRANSECT LOCATIONS
study area
0 6 12 Mls
0 9.6 19.2 Kms
40 Miles to Farmington
56
44
371
197
BT21
BT22
Bisle
BT23
BT14
Tanner Lake (north)
BT12
BT13
BT11
BT8
BT6
BT7
BT9
BT24
BT25
BT5
BT4
BT2
BT3
BT1
Kimbeto
Tsaya
Lake Valley
CHACO CANYON NATIONAL PARK
Chaco Wash
Pueblo Pintado
BT41
BT39
BT15
BT17
BT40
BT18
BT19
BT38
Pueblo Alto
BT20
Star Lake
BT27
BT26
BT30
BT31
BT28
EAGLE MESA
Johnson (Trading Post)
CHACO MESA
Mesa Cordata 7275
BT29
BT37
Torreon
BT35
BT36
BT34
BT33
BT32
Whitehorse
Hospah
Seven Lakes
Crown Point

Figure 13

Table 24. Avian survey transects and standard habitat sites in which they were located, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Transect Number	Standard Habitat Site
BT-1	Big Sagebrush/Galleta Rolling Uplands
BT-2	Greasewood/Rabbitbrush Dune
BT-3	Big Sagebrush/Galleta Rolling Uplands
BT-4	Badlands
BT-6	Alkali Sacaton/Annual Atriplex Swale
BT-7	Ricegrass/Snakeweed Dune
BT-8	Mixed Shrub Rolling Uplands
BT-9	Snakeweed/Galleta Uplands
BT-10	Greasewood/Rabbitbrush Dune
BT-11	Mixed Shrub Rolling Upland
BT-12	Greasewood/Rabbitbrush Dune
BT-13	Alkali Sacaton/Annual Atriplex Swale
BT-14	"
BT-15	Pinyon-Juniper/Sagebrush Hills
BT-16	"
BT-17	Badlands
BT-18	Badlands
BT-19	Big Sagebrush/Galleta Rolling Uplands
BT-20	Alkali Sacaton/Annual Atriplex Swale
BT-21	Ricegrass/Snakeweed Dune
BT-22	Greasewood/Rabbitbrush Dune
BT-23	Badlands
BT-24	Mixed Shrub Rolling Uplands
BT-25	Snakeweed/Galleta Uplands
BT-26	Pinyon-Juniper/Sagebrush Hills
BT-27	"
BT-28	Greasewood/Alkali Sacaton Drainage
BT-29	"
BT-30	Pinyon-Juniper Hills
BT-31	Big Sagebrush/Galleta Rolling Uplands
BT-32	Snakeweed/Galleta Uplands
BT-33	Mixed Shrub Rolling Uplands
BT-34	Snakeweed/Galleta Uplands
BT-35	Pinyon-Juniper Hills
BT-36	"
BT-37	"
BT-38	Greasewood/Alkali Sacaton Drainage
BT-39	Greasewood/Alkali Sacaton Drainage
BT-40	Big Sagebrush/Galleta Rolling Uplands
BT-41	Big Sagebrush/Galleta Rolling Uplands

provided in Appendix E. The transect lines dissected a continuous habitat site 1.6 km (one mile) in length and at least 250 meters in width, enabling the observer to record birds up to 125 m on either side of the transect line. All habitat sites contained four transects except ricegrass and big sagebrush. Because of the scarcity of ricegrass habitat only 2 transects were established in this type. Since big sagebrush is the predominant habitat site within the study area, an increased number of transects was warranted and 6 were established.

The census method was the same in all sampling periods. An observer walked slowly at a constant rate along the transect line recorded all birds seen and heard as well as their distance from the transect. Distances from the transect line were recorded with the help of rangefinders and were used in the analysis of census data as in Emlen (1971).

Each transect was run for three consecutive days within 3 hours after sunrise to take advantage of highest period of activity. If the wind speed exceeded 15 km per hour or visibility impaired by fog or snow, samples were postponed until conditions improved.

The species diversity, using the Shannon-Weaver Index, was calculated within each standard habitat site both seasonally and for the entire year.

Raptor Survey

The status of raptorial birds within the study area was documented through incidental sightings, helicopter surveys, and "on-the-ground" searches.

Every raptor observed was documented on BLM Form 6610-2, Wildlife Observation Report, to gain information concerning the relative abundance and general distribution within the study area. Information in the form of incidental sightings is often overlooked in scientific reports because informal and unsystematic collection methods cannot be presented with the confidence of statistical tests. Nevertheless, such data can be invaluable in establishing a baseline for longterm studies.

A helicopter was used to survey cliff areas to document the location of nests. Only those areas considered to have the highest potential for nesting were flown. Approximately 8 hours were used on June 9 and June 10 to survey approximately 480 miles of cliffs.

Vehicular and foot travel were used throughout the remainder of the study area. All nest locations were recorded on 7.5 minute USGS topographic maps.

A special night survey was used to document the occurrence of owls. Recordings of owl vocalizations were played repeatedly in likely areas of owl nesting during the spring sample. Owls are very territorial and will readily vocalize to recorded calls.

Results and Discussion

Table 25 shows the relative abundance (see Task 5, Introduction, for explanation of abundance categories) and habitat preference of every avian species observed on the Chaco Strippable Coal Wildlife Study Area. Included are the avian diversity indices for the entire study period within each SHS. The temporal distribution presented was the result of

Table 25. Seasonal status, nesting status, and habitat preference of avian species observed from November 1980 through July 1981, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Temporal Distribution and Relative Abundance						Habitat Preference													
	Fall	Winter	Spring	Summer	Migrant	Nesting Status[2]	Badlands	Alkali Sacaton/Annual Atriplex Swale	Snakeweed/Galleta Uplands	Ricegrass/Snakeweed Dunes	Mixed Shrub Rolling Uplands	Greasewood/Rabbitbrush Dune	Greasewood Alkali Sacaton Drainage	Big Sagebrush Rolling Uplands	Pinyon-Juniper Sagebrush Hills	Pinyon-Juniper Hills	Cliff/Rock Outcrops	Dry Lake Beds	Arroyos/Washes	Ponds/Water Tanks/Windmills/ Reservoirs/Flowing Wells and Creeks
Eared Grebe			U		O															X
Pied-billed Grebe	U				O															X
Snow Goose	U				Un															X
Mallard	U		U		C															X
Pintail	U		U		C															X
Gadwall	U		U		C															X
Shoveler	U		U		C															X
Blue-winged Teal	U		U		C															X
Cinnamon Teal	U		U		C															X
Green-winged Teal	U		U		C															X
Redhead	U		U		C															X
Lesser Scaup			U		O															X
Turkey Vulture	U		C	U										X	X					
Goshawk		U													X					
Cooper's Hawk	U		U		C								X		X					
Sharp-shinned Hawk	U	U			C								X		X					
*Northern Harrier	C	C	C	C			C	C	C	C	C	C	C	C	C				X	
Rough-legged Hawk				U	C			X		X		X		X						
Ferruginous Hawk	M					N	C		X	X	C		X						X	
*Red-tailed Hawk	C	C	C	C		N	X	X			C	X	X	C	C	X	C		X	
Swainson's Hawk		U	U	U		N					X						X			X
*Golden Eagle	C	C	C	C		N		X		X	X		X	C	X		C		X	X
*Prairie Falcon	C	C	C	C		N	X	X	X		C	X		C	X	X	C	X	X	
Merlin	U				O										X					
*American Kestrel	C	C	C	C		N	X	C	X	X	C	X	X	C	X	X	C		X	
*Scaled Quail	C	C	C	C		P	X	X	X		X	C	C	C				X	X	X
Snowy Egret			U		O															X
Great Blue Heron			U		O															X
White-faced Ibis			U		O															X
Sandhill Crane			U		O															X
American Coot			U		C															X
Mountain Plover			U	U		N		X										X		
Killdeer			U		C															X
Spotted Sandpiper			U		O															X
Willet	U		U		C															X
Least Sandpiper			U		O															X
Wilson's Phalarope	U		U		C															X
Common Snipe		U			O															X
Black Tern			U		Un															X
Rock Dove	U																			
Mourning Dove			C	C		N	X	C	X	C	C	X	C	X	X	X	X		X	X
Road Runner		U														X	X			
*Great-horned Owl	M	M	M	M		N									C	X	X	X	X	X
Long-eared Owl			U	U		P						X			X		X	X		
Short-eared Owl	U		U			P		X						X			X			X
Burrowing Owl			C	C		N		X	X		X		X	X						
Flammulated Owl - Status unknown - no positive identification																				

Table 25. Continued

Species	Temporal Distribution and Relative Abundance						Habitat Preference													
	Fall	Winter	Spring	Summer	Migrant	Nesting Status[2]	Badlands	Alkali Sacaton/Annual Atriplex Swale	Snakeweed/Galleta Uplands	Ricegrass/Snakeweed Dunes	Mixed Shrub Rolling Uplands	Greasewood/Rabbitbrush Dune	Greasewood Alkali Sacaton Drainage	Big Sagebrush Rolling Uplands	Pinyon-Juniper Sagebrush Hills	Pinyon-Juniper Hills	Cliff/Rock Outcrops	Dry Lake Beds	Arroyos/Washes	Ponds/Water Tanks/Windmills/Reservoirs/Flowing Wells and Creeks
Poor-will			U			N									X					
Common Nighthawk			U	C		P								X	X	X			X	
White-throated Swift			U													X	X		X	
Broad-tailed Hummingbird			U	U	O						X				X	X				
Rufous Hummingbird				U	O											X				
Common Flicker	U	U		U		P									X			X		
Hairy Woodpecker	U																			
Downy Woodpecker		U														X				
Lewis' Woodpecker			U												X					
Scissor-tailed Flycatcher			U		C						X									X
Western Kingbird			C			P														
Cassin's Kingbird				U		N											X			
Ash-throated Flycatcher			C	C		P			X				X		C	C	X		X	
Say's Phoebe			C	C		N	X	X	X	X	X	X	C	X	X	C	X		X	
Western Wood Pewee				U								X								
Empidonax Complex			M	M		P						X	X		X	X			X	
*Horned Lark	A	A	A	A		N	C	A	A	A	A	A	C	C	U	U	X		X	X
Barn Swallow			U		C									X						X
Cliff Swallow				U													X			X
Violet-green Swallow			U	U		N								X	X	X				X
Scrub Jay	U		U	U		P									X	X				
Pinyon Jay	C					P					X			X	X	C	X		X	
*Common Raven	A	A	A	A		N	X	C	C	C	C	C	C	C	C	C	X	X	X	X
Mountain Chickadee	C				C								X		X				X	
Plain Titmouse	C		C	C		P			X				X		C	C	X		X	
Bushtit	U		C	C		P					X				M	C				
White-breasted Nuthatch	U				C										X					
House Wren	U				C							X								
*Bewick's Wren	M	U	C	C		P			C		X	X	X		C	C	X	X	X	
Rock Wren			C	A		N	X		X		X	X	C		X	C	X		X	
Canyon Wren				U		P										X			X	
Long-billed Marsh Wren		U		O																X
Mockingbird			U	C				X				X	X		C				X	
Sage Thrasher			C	C		N	X		X	X	X	X	X	X	C				X	X
Bendire's Thrasher			C	C		N			X	X	X	X	X	X	X				X	X
American Robin	U				C										X					
Townsend's Solitaire	C	N	U												C	C				
*Mountain Bluebird	C	C	C	C		P			X				X		A	C			X	
Black-tailed Gnatcatcher			C		C								X		C				X	
Ruby-crowned Kinglet			U		O										X					
Water Pipit			U		O															X
Cedar Waxwing			U		C							X	X						X	
*Loggerhead Shrike	C	C	C	C		N		X	X		X	X	A	C	A	C	X		X	X
*Starling	U	U	U	U		P														
Hutton's Vireo			M	M											M	X				
Virginia's Warbler			U		C									X						
Yellow Warbler			U		C							X			X					

Table 25. Continued

Species	Temporal Distribution and Relative Abundance						Habitat Preference													
	Fall	Winter	Spring	Summer	Migrant	Nesting Status[2]	Badlands	Alkali Sacaton/Annual Atriplex Swale	Snakeweed/Galleta Uplands	Ricegrass/Snakeweed Dunes	Mixed Shrub Rolling Uplands	Greasewood/Rabbitbrush Dune	Greasewood Alkali Sacaton Drainage	Big Sagebrush Rolling Uplands	Pinyon-Juniper Sagebrush Hills	Pinyon-Juniper Hills	Cliff/Rock Outcrops	Dry Lake Beds	Arroyos/Washes	Ponds/Water Tanks/Windmills/ Reservoirs/Flowing Wells and Creeks
Yellow-rumped Warbler			U	U	C										X					
MacGillivray's Warbler				U	C										X					
Wilson's Warbler				U	C										X					
*Western Meadowlark	U	U	C	C		P		X	X	X	X	X	M	X	X	X			X	X
Yellow-headed Blackbird			U		C															X
Red-winged Blackbird			U		C															X
Brewer's Blackbird			U	U								X		X	X					
Brown-headed Cowbird		M	M		P							M	X	X	X	X			X	X
Scott's Oriole			U	U											X					
Northern Oriole			M	U									M		X		X		X	
Western Tanager				M								M			X					
Hepatic Tanager			U												X					
Rose-breasted Grosbeak				U											X					
Black-headed Grosbeak				U											X					
Blue Grosbeak				U	O								X							
*House Finch	C	C	C	C		P	X	X	X		X	M	M		C	X			X	X
Pine Siskin	U				C											X				
Green-tailed Towhee			C	C		P						M	C		X	X			X	
Rufous-sided Towhee			U	U											X	X	X			
Brown Towhee			C	M		P						C	X		X	X			X	X
Lark Bunting			U		C								X						X	
Lark Sparrow			C	C		P			X			C	C	X					X	
Black-throated Sparrow			A	A		N	X	X	M	C	A	C	C	X	C	C	X		X	
*Sage Sparrow	C	C	A	A		N	X		X	X	X	X	A	A	M		X		X	X
Dark-eyed Junco	C	C	U										M		C	C			X	
Tree Sparrow		U			C							X								
Chipping Sparrow			C	M		N					X	X	A	C	A	M			X	
Clay-colored Sparrow			C	A								M			A	M				
Brewer's Sparrow			A	A		N	X		M	M	X	M	A	A	C				X	
White-crowned Sparrow	U	U	M	U								X	X	X	X				X	
Lapland Longspur	U				O													X		
Total Species	50	28	90	63	52	P=18 N=24	16	19	24	14	28	38	42	32	66	39	26	9	43	47
Diversity Index							0.97	0.20	0.53	0.52	1.12	2.00	2.21	1.38	2.41	1.98				

[1]Relative Abundance: A = Abundant; C = Common; M = Moderately common; U = Uncommon; O = Occasional; Un = Unusual.

[2]Nesting Status: N = Active nest observed; P = Nesting within area probable.

[3]Habitat Preference: X = Observed utilizing habitat.
NOTE: Abundance categories as described above were also used under habitat preference.

*Species considered yearlong residents.

See text for more detailed description of these categories.

actual observations from transects and/or incidental recordings. The information within the table reflects only one year's data and future studies will probably show a different status of some species. We feel, however, that the table provides a useful overview of the avian life within the project area, and an accurate representation of the status of most species.

Permanent residents are those species observed during each seasonal sample period and are identified with an asterisk. Eighteen species are considered permanent residents.

Migrants are species which pass through the area moving between winter and summer residency. In some cases, the season in which a migrant was observed is also marked to give an idea of relative abundance. Three categories of migrants were used based on the experience of field biologists and the overall "commonness" of the species. A common migrant would be expected to be seen in the area consistently every year. An occasional migrant would be expected to be seen during migration but not consistently every year. An unusual migrant would seldom be observed in the area. A total of 15 species were classified as occasional, 35 were considered common and only 2 were considered unusual. It should be emphasized that these classifications could easily be changed when more long-term information becomes available. The abundance categories used are described in the introduction to Task 5.

The summer and spring seasons are certainly the most important in the study area in terms of the number of individuals, and bird species. In the summer, 63 species were recorded and 90 species were observed in the spring. At least 52 of these, however, were considered migrants.

This is in contrast to 28 species seen in the winter. The numbers of individuals appear to peak in the spring. The bulk of these individuals were members of species which probably nest within the study area. While migrants account for a large number of species, the project area does not appear to be important for a large number of strictly migratory individuals as their total numbers are relatively low.

Nesting Status

The nesting status of each species is shown on Table 25. A total of 24 species are known to nest and another 18 species probably nest since habitat appeared to be available. More detailed discussions of nesting are included in specific sections.

Habitat Preference

The final section of Table 25 shows the observed habitat preferences for each bird species. The habitats include both SHS's and the special habitat features most used. The observation of a species utilizing a certain habitat site is indicated by an "X". When data were sufficient, the abundance categories described earlier were used to show relative abundance within a habitat. It is important to recognize that the habitat preferences specified on the table refer only to observations within the study area and may not be the same as other geographic or physiographic locations. The number of species using each habitat site are shown at the bottom of Table 25. The diversity index is also included.

The pinyon-juniper/sagebrush hills SHS had the most species observed with 66 as well as the highest diversity index. The ricegrass/snakeweed dunes had the fewest species observed. The number of species and diversity index show definite increases as the height and structural complexity of the community increases. It is interesting to note that the SHS's which have the fewest species and the lowest diversity indices also comprise a majority of the study area. This indicates the importance of the smaller pockets of other habitats in supporting diversity in the area.

Song Bird Survey

Seasonal Sample Periods

Avian surveys were completed in November 1980 (fall), February 1981 (winter), May 1981 (spring), and June (summer) through early July (late summer) 1981. A total of 40 Emlen transects were completed during each of the months of November, May, and June for a grand total of 120. The winter (February) survey was reduced to 20 transects in order to use the remaining time to increase the sample in the late spring and summer during nesting and peak populations. During late June and early July, the remaining 20 transects (2 transects per 10 SHS's) that were not run in the winter were completed. In addition to the formal surveys of the standard habitat sites, inventories were conducted on cliffs and ponds. These habitats were considered the most important special habitat features for birds.

Tables 26, 27, 28, 29, and 30 show the avian abundance and species diversity within each standard habitat site for each of the sample periods. The number of birds for the fall and winter sample (Tables 26 and 27) is expressed as numbers seen per 1.6 km rather than a true density figure. The flocking behavior of birds during these seasons would cause inaccurate as well as unrealistically large density figures. The spring, summer, and late summer figures (Tables 28, 29, and 30) are expressed as birds per 40 hectares. A complete breakdown of all Emlen transect data can be found in Appendix B, including species of birds observed on each transect.

We attempted to arrange, on the tables, the bird species, as close as possible, according to habitat requirements, from the broadest to the most specific. In addition, the SHS's are arranged with least number of species observed on the left to the most observed on the right. This, hopefully, will be useful in determining which are the more sensitive species as well as the more important SHS's.

Fall Survey, November 1980

A total of 24 species of birds were observed during this sample period. The most abundant and broadly distributed species was the horned lark which was found in all SHS's but the pinyon-juniper/sagebrush and pinyon-juniper hills. This species was also found to be abundant and widely distributed by Springer and Candeleria (1980). The dark-eyed junco, mountain bluebird, house finch, and sage sparrow were also relatively abundant but were restricted in their distribution.

(Text continued on page 142)

Table 26. Avian abundance (no. of birds seen/1.6 km) and species diversity within standard habitat sites for the fall sample period, Chaco Strippable Coal Wildlife Study Area, New Mexico.

	Standard Habitat Site									
Species	Badlands	Alkali Sacaton/ Annual Atriplex Swale	Snakeweed/ Galleta Uplands	Ricegrass/ Snakeweed Dunes	Big Sagebrush/ Galleta Rolling Uplands	Mixed Shrub Rolling Uplands	Pinyon-Juniper Hills	Greasewood/ Alkali Sacaton Drainage	Greasewood/ Rabbitbrush Dunes	Pinyon-Juniper/ Sagebrush Hills
Horned Lark	3.9	98.3	50.0	7.2	8.5	32.0	-	12.8	21.4	-
Sage Sparrow				0.5		0.75		3.4	11.5	0.1
Loggerhead Shrike			0.2			0.25		0.25	0.2	
House Finch						0.2		7.0	5.1	12.5
Brown Towhee						0.25		0.8	0.2	0.2
Bewick's Wren							0.1	0.7	0.25	0.7
Dark-eyed Junco							10.0	4.25		13.8
White-crowned Sparrow								0.8	0.1	
Scaled Quail					0.7				1.8	
Mountain Chickadee								0.1		0.75
Townsend's Solitaire							4.4			4.2
Plain Titmouse					3.1					0.9
Common Flicker							0.2			0.2
Mountain Bluebird							0.1			20.6
House Wren									0.1	
Long-eared Owl									0.1	
Northern Harrier									0.1	
Western Meadowlark								0.1		
Rock Dove							0.2			
Scrub Jay										0.1
American Robin										0.1
Pine Siskin							0.25			
Great-horned Owl										0.1
Pinyon Jay										4.6
White-breasted Nuthatch										0.1
Merlin										0.1
Total # Species	1	1	2	2	3	5	8	10	11	16
Diversity Index	0	0	0.09	0.38	0.21	0.35	1.01	1.20	1.31	1.01

Table 27. Avian abundance (no. of birds seen/1.6 km) and species diversity within standard habitat sites for the winter sample period, Chaco Strippable Coal Wildlife Study Area, New Mexico.

	Standard Habitat Site									
Species	Alkali Sacaton/ Annual Atriplex Swale	Ricegrass/ Snakeweed Dunes	Big Sagebrush/ Galleta Rolling Uplands	Badlands	Snakeweed/ Galleta Uplands	Pinyon-Juniper Hills	Mixed Shrub Rolling Uplands	Greasewood/ Rabbitbrush Dunes	Greasewood/ Alkali Sacaton Drainage	Pinyon-Juniper/ Sagebrush Hills
Horned Lark	104.3	19.8	1.8	8.8	33.8		19.0	2.2	1.3	0.7
House Finch				0.75				8.0		
Sage Sparrow							4.7	3.2	5.8	0.3
Bewick's Wren							0.3		0.2	9.5
Dark-eyed Junco						14.3			0.7	2.0
Townsend's Solitaire						0.3				
Common Flicker								0.2		
Northern Harrier							0.2			0.2
Common Raven					0.3					
White-crowned Sparrow									1.0	0.3
Great-horned Owl										2.8
Plain Titmouse										2.33
Mountain Bluebird										0.2
Red-tailed Hawk										9
Total # Species	1	1	1	2	2	2	4	4	5	
Diversity Index	0	0	0	0.14	0.06	0.06	0.61	0.96	1.20	1.98

Table 28. Avian densities (no. of birds/40 hectares) and species diversity within standard habitat sites for the spring sample, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Sites									
	Alkali Sacaton/ Annual Atriplex Swale	Ricegrass/ Snakeweed Dunes	Badlands	Mixed Shrub Rolling Uplands	Big Sagebrush/ Galleta Rolling Uplands	Snakeweed/ Galleta Uplands	Pinyon-Juniper Hills	Greasewood/ Rabbitbrush Dunes	Greasewood/ Alkali Sacaton Drainage	Pinyon-Juniper Hills
Black-throated Sparrow	1.05	1.68	0.63	17.0	0.5	6.2	0.56	5.15	7.9	4.2
Horned Lark	163.0	38.0	4.2	69.9	15.36	107.2	-	7.3	4.6	0.52
Western Meadowlark	1.5	0.38	-	1.1	0.78	2.1	0.19	2.0	1.52	0.19
Brewer's Sparrow	-	2.1	0.7	1.8	71.7	0.28	-	5.06	51.5	3.24
Say's Phoebe	-	0.21	0.37	2.1	0.25	0.21	1.05	0.58	0.23	0.22
Mourning Dove	-	8.4	2.1	0.63	2.1	0.26	0.52	3.1	-	1.26
Rock Wren	-	-	1.8	1.0	-	0.52	4.86	0.26	0.57	0.19
Sage Sparrow	-	-	2.1	0.35	28.2	0.38	-	1.72	51.5	4.02
House Finch	2.45	-	-	0.7	-	0.60	1.58	0.76	0.38	4.2
Loggerhead Shrike	0.3	-	-	0.42	0.32	0.26	-	0.63	1.3	-
Chipping Sparrow	-	-	-	2.1	8.4	-	2.44	2.1	37.8	35.7
Sage Thrasher	-	-	0.15	-	1.0	0.14	-	-	0.46	6.3
Bewick's Wren	-	-	-	2.1	-	-	6.46	1.4	1.0	0.58
Lark Sparrow	-	-	-	-	0.93	0.38	-	10.0	0.33	-
Mountain Bluebird	-	-	-	-	-	0.52	0.75	-	0.22	6.94
Bendire's Thrasher	-	2.1	-	-	3.1	0.2	-	2.77	-	-
Common Raven	0.19	-	-	0.14	-	-	-	-	12.6	-
Mockingbird	0.19	-	-	-	-	-	-	3.15	1.9	-
Plain Titmouse	-	-	-	-	-	-	4.2	-	2.1	4.0
Brown Towhee	-	-	-	-	-	-	1.68	13.6	0.21	-
Empidonax	-	-	-	-	-	-	0.15	2.1	-	2.94
Scaled Quail	-	-	-	0.2	0.27	-	-	4.2	-	-
Green-tailed Towhee	-	-	-	-	-	-	0.46	4.16	10.5	1.05
White-crowned Sparrow	-	-	-	-	-	-	-	2.1	4.0	-
Brown-headed Cowbird	-	-	-	-	-	-	1.05	-	0.35	-
Black-tailed Gnatcatcher	-	-	-	-	-	-	-	-	1.4	18.9
Yellow Warbler	-	-	-	-	-	-	-	4.2	-	1.05
American Kestrel	-	-	-	-	-	0.14	-	-	-	0.58
Burrowing Owl	-	-	-	-	-	0.14	-	-	-	3.44
Pinyon Jay	-	-	-	-	0.47	-	10.05	-	-	-
Ash-throated Flycatcher	-	-	-	-	-	-	1.05	-	-	0.52
Rufous-sided Towhee	-	-	-	-	-	-	0.46	-	-	0.52
Hutton's Vireo	-	-	-	-	-	-	0.38	-	-	1.16
Bushtit	-	-	-	-	-	-	2.1	-	-	1.68
Cooper's Hawk	-	-	-	-	-	-	-	-	2.1	-
Brewer's Blackbird	-	-	-	-	0.25	-	-	0.42	-	-
Broad-tailed Hummingbird	-	-	-	-	-	-	0.52	-	-	-

Table 28. Continued

Species	Standard Habitat Sites									
	Alkali Sacaton/ Annual Atriplex Swale	Ricegrass/ Snakeweed Dunes	Badlands	Mixed Shrub Rolling Uplands	Big Sagebrush/ Galleta Rolling Uplands	Snakeweed/ Galleta Uplands	Pinyon-Juniper Hills	Greasewood/ Rabbitbrush Dunes	Greasewood/ Alkali Sacaton Drainage	Pinyon-Juniper Hills
Northern Oriole	-	-	-	-	-	-	-	-	4.2	-
Western Kingbird	-	-	-	-	-	-	-	-	1.2	-
Virginia's Warbler	-	-	-	-	-	-	-	-	0.78	-
Yellow-headed Blackbird	-	-	-	-	-	-	-	-	1.2	-
Prairie Falcon	-	-	-	-	-	-	-	-	0.3	-
Killdeer	-	-	-	-	-	-	-	-	0.38	-
Mountain Plover	-	-	0.13	-	-	-	-	-	-	-
Clay-colored Sparrow	-	-	-	-	-	-	-	6.56	-	-
House Wren	-	-	-	-	-	4.2	-	-	-	-
Yellow-rumped Warbler	-	-	-	-	-	-	-	-	-	5.25
Lewis' Woodpecker	-	-	-	-	-	-	-	-	-	0.13
Gray-headed Junco	-	-	-	-	-	-	-	-	-	0.52
Scott's Oriole	-	-	-	-	-	-	-	-	-	0.38
Scrub Jay	-	-	-	-	-	-	-	-	-	0.95
Townsend's Solitaire	-	-	-	-	-	-	-	-	-	0.19
Common Nighthawk	-	-	-	-	-	-	-	-	-	2.1
Hepatic Tanager	-	-	-	-	-	-	-	-	-	0.23
Violet-green Swallow	-	-	-	-	-	-	2.1	-	-	-
Total # Species	7	7	9	14	15	17	21	23	29	32
Diversity Index	0.45	0.92	1.64	1.62	2.19	0.96	2.41	2.52	2.84	2.96

Table 29. Avian densities (no. of birds/40 hectares) and species diversity within the standard habitat sites for the summer sample period, Chaco Strippable Coal Wildlife Area, New Mexico.

Species	Standard Habitat Sites									
	Alkali Sacaton/ Annual Atriplex Swale	Badlands	Ricegrass/ Snakeweed Dunes	Big Sagebrush/ Galleta Rolling Uplands	Snakeweed/ Galleta Uplands	Mixed Shrub Rolling Uplands	Greasewood/ Rabbitbrush Dunes	Pinyon-Juniper Hills	Greasewood/ Alkali Sacaton Drainage	Pinyon-Juniper/ Sagebrush Hills
Horned Lark	101.47	7.6	72.67	7.66	65.2	64.67	6.2	1.7	3.29	-
Mourning Dove	4.2	-	2.5	1.8	0.42	0.23	2.88	2.1	4.2	2.1
Brewer's Sparrow	-	0.12	4.2	12.67	6.28	0.92	1.4	-	16.86	12.6
Western Meadowlark	0.11	-	0.84	0.33	1.7	0.52	0.09	-	1.4	0.19
Black-throated Sparrow	-	-	6.75	0.09	1.7	28.67	2.1	12.6	11.8	1.4
Rock Wren	-	2.67	-	-	0.75	3.0	0.63	7.8	4.2	0.7
Say's Phoebe	-	0.33	-	-	0.17	0.42	0.65	2.1	1.83	0.49
House Finch	0.52	1.05	-	-	-	-	1.32	2.8	0.38	3.05
Sage Sparrow	-	0.76	1.05	46.0	-	0.46	2.43	-	12.3	24.7
Mockingbird	-	-	-	-	0.23	-	3.36	0.95	4.8	0.33
Sage Thrasher	-	-	-	0.38	-	0.38	1.2	-	3.43	1.34
Bewick's Wren	-	-	-	-	-	0.23	0.84	1.4	0.42	8.38
Lark Sparrow	-	-	-	-	-	0.53	0.32	0.35	12.67	3.15
Bendire's Thrasher	-	-	-	-	-	0.33	1.6	-	1.0	0.35
Loggerhead Shrike	-	-	-	0.26	-	-	0.9	1.0	0.56	-
Brown-headed Cowbird							2.1	0.78	0.9	1.12
Mountain Plover	0.57	-	-	-	0.19	0.26	-	-	-	-
Pinyon Jay	-	-	-	-	-	0.7	-	1.6	-	2.86
Broad-tailed Hummingbird	-	-	-	-	-	1.0	-	2.1	-	2.1
Scaled Quail	-	-	-	1.4	-	-	4.2	-	0.6	-
Cassin's Kingbird	-	-	-	-	-	-	-	0.25	0.21	2.29
Empidonax	-	-	-	-	-	-	-	0.23	2.1	0.57
Mountain Bluebird	-	-	-	-	1.05	-	-	-	-	0.21
Burrowing Owl	-	-	1.05	-	-	-	14.0	-	-	-
Western Tanager	-	-	-	-	-	-	6.3	-	-	0.25
White-crowned Sparrow	-	-	-	-	-	-	-	-	1.1	0.35
American Kestrel	-	-	-	-	-	-	-	-	0.3	0.12
Chipping Sparrow	-	-	-	-	-	-	-	-	0.23	21.0
Common Nighthawk	-	-	-	0.28	-	-	-	-	-	1.05
Brown Towhee	-	-	-	-	-	-	-	0.9	0.42	-
Ash-throated Flycatcher	-	-	-	-	-	-	-	3.1	-	2.25
Plain Titmouse	-	-	-	-	-	-	-	6.3	-	3.5
Clay-colored Sparrow	-	-	-	-	-	-	-	7.35	-	29.43
Rufous-sided Towhee	-	-	-	-	-	-	-	0.1	-	1.6
Scrub Jay	-	-	-	-	-	-	-	4.2	-	0.95
Violet-green Swallow	-	-	-	-	-	-	-	1.4	-	0.10
Red-winged Blackbird	-	-	-	-	1.05	-	-	-	-	-

Table 29. Continued

Species	Standard Habitat Sites									
	Alkali Sacaton/ Annual Atriplex Swale	Badlands	Ricegrass/ Snakeweed Dunes	Big Sagebrush/ Galleta Rolling Uplands	Snakeweed/ Galleta Uplands	Mixed Shrub Rolling Uplands	Greasewood/ Rabbitbrush Dunes	Pinyon-Juniper Hills	Greasewood/ Alkali Sacaton Drainage	Pinyon-Juniper/ Sagebrush Hills
Brown-headed Cowbird	-	-	-	-	-	0.93	-	-	-	-
Western Wood Pewee							0.42			
Brewer's Blackbird									0.53	
Blue Grosbeak									0.23	
Green-tailed Towhee									0.7	
Canyon Wren								0.12		
Long-eared Owl								2.1		
Bushtit								8.33		
Great-horned Owl										0.53
Common Flicker										0.6
Rose-breasted Grosbeak										0.35
Common Raven										0.03
Black-headed Grosbeak										1.05
Yellow-rumped Warbler										0.84
Scott's Oriole										0.31
Hutton's Vireo										5.25
Wilson's Warbler										2.1
Northern Oriole										2.1
MacGillivray's Warbler										2.1
Total # Species	5	6	7	10	11	16	20	25	26	41
Diversity Index	0.28	1.17	0.73	1.85	0.74	1.09	2.96	2.91	2.87	3.08

Table 30. Avian densities (no. of birds/40 hectares) and species diversity within standard habitat sites for the late summer sample, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Sites									
	Alkali Sacaton/ Annual Atriplex Swale	Badlands	Big Sagebrush/ Galleta Rolling Uplands	Mixed Shrub Rolling Uplands	Ricegrass/ Snakeweed Dunes	Greasewood/ Rabbitbrush Dunes	Snakeweed/ Galleta Uplands	Pinyon-Juniper Hills	Greasewood/ Alkali Sacaton Drainage	Pinyon-Juniper/ Sagebrush Hills
Horned Lark	544.89	1.26	5.43	59.18	75.83	383.7	30.0	1.57	3.9	-
Mourning Dove	0.84	-		4.2	2.8	1.89	2.1	0.78	0.23	0.41
Rock Wren		2.79		-	-	2.29	13.13	4.75	39.2	4.18
House Finch		0.44		0.28	-	3.55	-	2.3	0.53	1.9
Black-throated Sparrow		-		5.35	14.32	16.8	0.77	-	1.4	12.4
Say's Phoebe		0.41				4.2	0.53	1.8	2.0	
Brewer's Sparrow			36.5	2.52	0.84		-	-	23.2	4.19
Western Meadowlark					1.20		1.53	0.49	1.05	
Bendire's Thrasher						1.68	1.4	-	0.90	1.04
Ash-throated Flycatcher							1.05	1.0	1.4	1.11
Loggerhead Shrike						0.42	0.3	0.3	5.48	2.8
Sage Sparrow			42.0		0.76			-	0.76	7.5
Sage Thrasher				0.28	0.42			-	1.96	0.28
Mountain Bluebird							0.25	4.2		1.28
Bewick's Wren							17.5	12.25		9.32
Plain Titmouse							0.38	0.76		6.63
Brown-headed Cowbird			1.4			0.93			2.1	
Mockingbird						1.73			0.93	4.15
Pinyon Jay							0.46	0.46		
Lark Sparrow						2.52			2.39	
Scaled Quail						1.51			0.3	
Brown Towhee									0.76	2.54
Chipping Sparrow								1.15		25.62
Hutton's Vireo								0.84		2.0
Empidonax								1.0		0.84
Scrub Jay								0.56		0.36
Mountain Plover	0.88									
Burrowing Owl					0.26					
Blue Grosbeak									2.1	
Rufous-sided Towhee										0.4
Cassin's Kingbird										0.74
Scott's Oriole										0.57
Bushtit										0.50
Total Number of Species	3	4	4	6	8	12	13	16	19	23
Diversity Index	0.12	1.33	1.56	1.47	0.56	1.72	1.3	2.48	2.74	3.41

The pinyon-juniper/sagebrush hills had the highest number of species observed of all the SHS's with 17 and the highest diversity index. The most abundant species was the mountain bluebird with about 21 birds seen per 1.6 km. The dark-eyed junco and house finch were also abundant with about 14 and 12 birds seen per 1.6 km, respectively. The only merlin seen during the entire survey was observed in this SHS in the fall. Other species unique to this SHS during the fall were scrub jay, American robin, pine siskin, great-horned owl, pinyon jay, and white-breasted nuthatch. The importance of the pinyon-juniper to the mountain bluebird can be seen from the number of these birds observed. The greasewood/rabbitbrush dune SHS had the second highest number of species observed with 11, as well as the second highest diversity index. The horned lark was the most abundant species with 21.4 birds seen per 1.6 km. The sage sparrow, with 11.5 birds seen per 1.6 km was also quite common. The house finch was the only other songbird species which exceeded 1 bird seen per 1.6 km. Species observed exclusively in this SHS include long-eared owl and marsh hawk.

The greasewood/alkali sacaton drainage had 10 species observed with the horned lark again being the most abundant. The next species in order of abundance were the house finch, dark-eyed junco, and sage sparrow. There were no species observations unique to this SHS during the fall sample.

The pinyon-juniper hills SHS had 7 different species observed. The most common was the dark-eyed junco with 10 birds seen per 1.6 km. Townsend's solitaire was next in abundance with 4.4 birds seen per 1.6 km. A species observation unique to this type was the rock dove.

Mixed shrub had 5 different species observed with the horned lark being overwhelmingly the most abundant species. None of the other four species exceeded 1 bird seen per 1.6 km. The remaining 5 SHS's had 2 or fewer species with horned lark being highly abundant. The horned larks preference for the more open habitats may explain their abundance in these SHS's (Ligon 1961).

Winter Survey, February 1981

Only 14 species were observed on the Emlen transects during this sample period (Table 27). The horned lark again was, by far, the most abundant species observed. The dark-eyed junco was the next most abundant but this species occupies the pinyon-juniper types and not the open grassland and low shrub types as does the horned lark.

As in the fall, the pinyon-juniper/sagebrush hills had the most species with 9 and highest diversity of any other SHS. The most abundant species was the dark-eyed junco. The next in abundance were the plain titmouse, mountain bluebird, Townsend's solitaire, and Bewick's wren which were nearly equal in numbers.

The greasewood/alkali sacaton drainage had a total of 5 species observed. The sage sparrow was the most abundant species in this SHS with 5.8 birds seen per 1.6 km.

The remaining SHS's had 4 or less species observed and all but the pinyon-juniper hills had the horned lark. The importance of the alkali sacaton/annual atriplex swale to the horned lark during the colder seasons is evidenced by the tremendous numbers observed in both the fall and winter sample.

Spring Survey, May 1981

A total of 55 species were observed during this sample period (Table 28). Although the horned lark was again the most abundant species, the extreme flocking behavior begins to diminish somewhat during the breeding season. The dark-eyed junco, common during the fall and winter, completely disappeared indicating it is only a winter resident.

Other common spring species include the black-throated sparrow, Brewer's sparrow, sage sparrow, and chipping sparrow.

The pinyon-juniper/sagebrush hills had both the highest number of species and highest diversity index. The chipping sparrow and black-tailed gnatcatcher had the highest densities with 36 and 19 birds per 40 ha, respectively. The mountain bluebird, although the third highest in density, was much less abundant than in the winter as would be expected during the breeding season.

The greasewood/alkali sacaton drainage had the second highest number of species with 29. The bird populations in this type were dominated by the sparrows. The brewer's and sage sparrow had the same density of 51.5 birds per 40 ha. The chipping sparrow was also abundant with 39 birds per 40 ha. The Cooper's hawk, which would normally be considered a woodland species (Jones 1979) was observed only in this SHS during the spring sample.

The brown towhee and lark sparrow were the most common species in the rabbitbrush dune but no single species was overwhelmingly abundant. The clay-colored sparrow was found only in this SHS in the spring.

The pinyon-juniper hills appeared to be the most important SHS for the wrens. Although the Bewick's and rock wren were found in other SHS's, they were most abundant here. The pinyon jay also preferred the pinyon-juniper.

The sagebrush community had the highest number of Brewer's sparrow of any SHS. The sage sparrow was also quite abundant with 28 birds per 40 hectares. The remaining SHS's were totally dominated by the horned lark.

Summer Survey, June 1981

A total of 56 species of birds were identified during this sample period. The horned lark was again the most common. The sparrows also remained quite common. Some interesting shifts in abundance between SHS's can be seen, however, from Table 29. The Brewer's sparrow increased in the snakeweed/galleta and pinyon-juniper/sagebrush but decreased the greasewood/alkali sacaton drainage and big sagebrush. Habitat utilization by the sage sparrow shifted from the greasewood drainage to the pinyon-juniper/sagebrush and the lark sparrow from greasewood/rabbitbrush dunes to the greasewood drainage. One of the more interesting changes was the clay-colored sparrow's shift from the greasewood/rabbitbrush dunes to both of the pinyon-juniper types. Other than these specific differences, however, the general trends in species composition, diversity, and habitat utilization found during the spring survey are also evident in the summer.

Late Summer Survey, Late June and Early July, 1981

The number of species identified during this sample period was 33 (Table 30). The decrease in species indicated the ending of the breeding season and the dispersal of populations. Some flocking behavior was already beginning as noted by the number of horned larks observed in some SHS's. This was the only time when large numbers of horned larks used the greasewood/rabbitbrush dunes. Possibly a large number of preferred seeds became available. The rock wren became abundant in the greasewood/alkali sacaton drainage and snakeweed/galleta and the sage sparrow became the most abundant in the big sagebrush community. The same trends found in the summer, however, are also seen in this sample period.

Nest Survey

Although not a specific requirement of the study, songbird nests found along the Emlen transects were recorded. Table 31 summarizes the results of the nest survey.

A total of 38 nests of 14 different species were located. The only unusual nest was that of a mountain plover found near Tanner Lake (North). Tolle (1976) also reported mountain plover nests in San Juan County northwest of the Burnham Trading Post. The most commonly found nests were those of the sparrows. The four species were black-throated sparrow (5 nests), sage sparrow (7 nests), chipping sparrow (6 nests), and Brewer's sparrow (5 nests). Four out of 5

Table 31. Nests located during the songbird survey, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Site or Special Habitat Feature	Nest Location and/or Description	Eggs	Young
Mountain Plover	Alkali Sacaton/Annual Atriplex Swale near Greasewood Wash	Depression in ground lined with with saltbush leaves	3	
Mourning Dove	Big Sagebrush Rolling Hills	Ground	2	
Poor-will	Pinyon-Juniper Sagebrush Hills	Shallow depression in ground	2	
Cassin's Kingbird	Pinyon-Juniper Sagebrush Hills	Stick nest on power pole support		
Say's Phoebe	Badlands	On ledge in cave		
Say's Phoebe	Badlands	In cave		
Say's Phoebe	Badlands	In cave	2	
Horned Lark	Ricegrass/Snakeweed Dunes	Depression in clump of grass	3	
Violet-green Swallow	Pinyon-Juniper Hills	Hole in cliff		
Rock Wren	Pinyon-Juniper Hills	Constructed of sticks and small rocks		4
Sage Thrasher	Big Sagebrush Rolling Uplands	In sagebrush plant	3	
Sage Thrasher	Pinyon-Juniper Sagebrush Hills	In sagebrush plant		
Bendire's Thrasher	Big Sagebrush Rolling Uplands next to dry lake bed	In sagebrush plant	3	
Loggerhead Shrike	Big Sagebrush Rolling Uplands next to tamarisk lined dry lake bed	In tamarisk tree		4
Loggerhead Shrike	Mixed Shrub Rolling Uplands	In saltbush plant	6	
Black-throated Sparrow	Greasewood/Alkali Sacaton Drainage	Grass nest in sagebrush plant	4	
Black-throated Sparrow	Cliff	Grass nest in saltbush plant	3	
Black-throated Sparrow	Mixed Shrub Rolling Upland	Grass nest supported by both a shadscale and rabbit-brush plant		
Black-throated Sparrow	Snakeweed/Galleta Uplands	Grass nest in four-wing saltbush plant		
Black-throated Sparrow	Ricegrass/Snakeweed Dunes	Grass nest in four-wing saltbush plant	3	
Sage Sparrow	Big Sagebrush Rolling Uplands	Grass and small twig nest in sagebrush plant	3	

Table 31. Continued

Species	Standard Habitat Site or Special Habitat Feature	Nest Location and/or Description	Eggs	Young
Sage Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	3	
Sage Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	3	
Sage Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	3	
Sage Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	4	
Sage Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	4	
Sage Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant	3	
Chipping Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant		
Chipping Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant		
Chipping Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant		
Chipping Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant	3	
Chipping Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant	4	
Chipping Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant		3
Brewer's Sparrow	Pinyon-Juniper Sagebrush Hills	In sagebrush plant		
Brewer's Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	3	
Brewer's Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	3	
Brewer's Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant	3	
Brewer's Sparrow	Big Sagebrush Rolling Uplands	In sagebrush plant		

Brewer's and 6 out of 7 sage sparrow nests were in sagebrush communities. The other nests were in pinyon-juniper sagebrush. All of the chipping sparrow nests were found in pinyon-juniper sagebrush. The black-throated sparrow appears to be much less specific in nesting habits since every nest found was in a different habitat site. It is interesting to note that all of the Say's phoebe nests were found in cavities in the badlands.

Incidental Sightings

Table 32 shows the incidental sightings of bird species considered unusual or of high interest within the study area. Most of the shorebirds and waterfowl use the temporary ponds as a rest stop during migration. The only nest found was that of the mountain plover. One particular reservoir, Tanner Lake (South) was especially important to migrating waterfowl and shorebirds. It accounted for over 50% of the incidental sightings listed.

Raptor Survey

Table 33 shows the raptor sightings by season. The low number of sightings in the summer as compared to other seasons was due to a lack of recording by field personnel rather than low numbers of raptors. Field personnel were involved in several tasks which did not allow them time to record all observations. We believe, however, that the total observations are an accurate representation of the relative abundance of raptors in the study area.

Table 32. Incidental sightings of bird species considered unusual or of high interest, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Number	Date	Activity	Location	
Eared Grebe	1	4/27/81	Feeding; resting	T20N, R7W, S. 15	Tanner Lake (South)
Pied-billed Grebe	1	8/31/81	" "	T21N, R10W, S. 13	Gallo Wash
Snow Goose	31	11/16/81	Flying overhead	T22N, R11W, S. 9	De-Na-Zin Wash
Mallard	1	11/15/80	Feeding; resting	T22N, R13W, S. 14	Pond in De-Na-Zin Wash
Pintail	8	11/15/80	" "	T20N, R7W, S. 15	Tanner Lake (South)
Gadwall	8	10/21/80	" "	T21N, R9W, S. 17	Stock pond in Gallo Wash
Gadwall	1	11/15/80	" "	T22N, R13W, S. 14	Pond in De-Na-Zin Wash
Shoveler	8	5/1/81	" "	T20N, R7W, S. 15	Tanner Lake (South)
Blue-winged Teal	12	"	" "	"	"
Cinnamon Teal	1	"	" "	"	"
Green-winged Teal	15	"	" "	"	"
Redhead	2	"	" "	"	"
Lesser Scaup	1	"	" "	"	"

Table 32. Continued

Species	Number	Date	Activity	Location	
Snowy Egret	2	4/27/81	Feeding; resting	T20N, R7W, S. 15	Tanner Lake (South)
Great Blue Heron	1	"	" "	"	"
White-faced Ibis	3	5/6/81	" "	T23N, R12W, S. 17	Tanner Lake (South)
Sandhill Crane	1	11/16/80	Flying overhead	T22N, R10W, S. 16	
American Coot	7	4/27/81	Feeding; resting	T20N, R7W, S. 15	Tanner Lake (South)
Mountain Plover	1	5/14/81	Sitting on nest	T23N, R13W, S. 18	Tanner Lake (North)
Mountain Plover	2	5/29/81	Building nest	T20N, R6W, S. 34	Near Star Lake Pump Station
Mountain Plover	1	6/9/81	Flying	T23N, R12W, S. 28	East of Black Lake Ranch
Mountain Plover	1	6/16/81		T20N, R6W, S. 34	Near Star Lake Pump Station
Mountain Plover	4	6/17/81		"	"
Mountain Plover	6	7/25/81		"	"
Killdeer	2	5/1/81	Feeding	T20N, R7W, S. 15	Tanner Lake (South)
Spotted Sandpiper	1	5/11/81	"	T17N, R4W, S. 6	County Line Tank
Willet	2	4/27/81	"	T20N, R7W, S. 15	Tanner Lake (South)
Least Sandpiper	4	5/11/81	"	"	"

Table 32. Continued

Species	Number	Date	Activity	Location	
Least Sandpiper	6	5/1/81	Feeding	T20N, R7W, S. 15	Tanner Lake (South)
Wilson's Phalarope	Ca. 60	5/1/81	"	"	"
Wilson's Phalarope	8	5/24/81	"	"	"
Common Snipe	1	2/8/81	"	T16N, R5W, S. 19	Flowing well at base of Mesa Cortada
Black Tern	1	5/24/81		T20N, R7W, S. 15	Tanner Lake (South)
Roadrunner	1	2/8/81	Running	T16N, R5W, S. 24	Base of Cerro Parido
Water Pipit	1	5/11/81	Feeding	T17N, R4W, S. 6	County Line Tank
Yellow-headed Blackbird	2	5/1/81	"	T20N, R7W, S. 15	Tanner Lake (South)
Red-winged Blackbird	3	5/11/81	"	T17N, R4W, S. 6	County Line Tank
Hutton's Vireo	1	6/20/81	"	T20N, R4W, S. 33	Eagle Mesa

Table 33. Raptor sightings, by season, on the Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Fall	Winter	Spring	Summer	Total
Turkey Vulture	3		21	2	26
Goshawk		1			1
Cooper's Hawk	3		2		6
Sharp-shinned Hawk	2	1			3
Northern Harrier	28	14	6		45
Rough-legged Hawk	4	6	1		11
Ferruginous Hawk	21	3	7	9	40
Red-tailed Hawk	46	20	37	10	113
Swainson's Hawk		3	2		5
Golden Eagle	32	15	14	9	70
Prairie Falcon	57	24	8	15	104
Merlin	1				1
American Kestrel	56	27	48	15	146
Great Horned Owl	11	7	10	3	31
Long-eared Owl			7	3	10
Short-eared Owl	3		2		5
Burrowing Owl			9	12	21
Flammulated Owl				1[1]	
Common Raven	30	59	202	2	193

[1]Possible sighting but no positive identification.

The most common raptor was the American kestrel with 146 observations. The red-tailed hawk and prairie falcon were also quite common, with 113 and 104 observations, respectively. The golden eagle would also be considered common with 70 observations. The least common raptors were the accipiters which would be expected because of a lack of suitable habitat. Although the common raven is not considered a true raptor, it was most easily censused during the raptor survey. The raven was very abundant on the study area with 293 observations.

Table 34 gives a breakdown of the active raptor nests located during the spring, 1981, nest survey, including the nest structure and substrate. All nest sites were recorded on 7.5 minute USGS topographic maps, which are on file in the Farmington Resource Area Office of the Bureau of Land Management. Raven nests are included because of their similarity of nesting habits and the fact that they can sometimes compete with raptors for nest sites. Figure 14 shows the general distribution of the raptor nests within and around the study area. There are nine nests located on the edge or just outside the boundary and four nests identified which are well outside the study area.

The American kestrel appeared to be the most common nesting raptor with 12 nests located. It is expected that many more nests were not found because of the kestrel's highly variable nesting habits. The red-tailed hawk, prairie falcon, and golden eagle were also common nesters with 10, 7, and 6 nests, respectively. The least common nesting raptor was the Swainson's hawk with one nest found. The only owl nests identified were those of the great-horned and burrowing owls.

Table 34. Raptor nest sites found on the Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Date Observed	Location	Map Reference (USGS 7.5 min. quad)	Nest Structure, Substrate	Eggs	Young
American Kestrel	6/10	T22N, R11W, S. 10, SW¼	Pueblo Bonito NW	cavity, cliff		
" "	5/25	T20N, R4W, S. 33, NE¼	Ojo Encino Mesa	cavity, cliff		
" "	5/3	T19N, R5W, S. 12, SE¼	Ojo Encino Mesa	cavity, cliff		
" "	5/4	T20N, R5W, S. 30, NW¼	Star Lake	cavity, cliff		
" "	5/2	T20N, R6W, S. 34, NW¼	Star Lake	cavity, cliff		
" "	5/25	T20N, R4W, S. 34, SE¼	Johnson Trading Post	cavity, cliff		
" "	5/6	T19N, R4W, S. 3, NE¼	Johnson Trading Post	cavity, cliff		
" "	5/8	T19N, R4W, S. 1, SW¼	Johnson Trading Post	cavity, cliff		
" "	6/10	T22N, R8W, S. 32, NE¼	Fire Rock Well	cavity, cliff		
" "	6/9	T23N, R13W, S. 1, NE¼	Alamo Mesa West	cavity, cliff		
" "	5/1	T21N, R7W, S. 28, SE¼	Lybrook SE	cavity, cliff		
" "	5/21	T22N, R11W, S. 16, NE¼	Pretty Rock	cavity, cliff		
Great Horned Owl	5/25	T20N, R4W, S. 34, SE¼	Johnson Trading Post	cavity, cliff		
" " "	5/12	T19N, R6W, S. 16, SE¼	Rincon Marquez	stick, cliff		3
" " "	5/25	T20N, R4W, S. 33, NW¼	Ojo Encino Mesa	cavity, cliff		

Table 34. Continued

Species	Date Observed	Location	Map Reference (USGS 7.5 min. quad)	Nest Structure, Substrate	Eggs	Young
Great Horned Owl	5/30	T17N, R5W, S. 36, SE¼	Canada Calladita	cavity, cliff		
" " "	5/2	T20N, R5W, S. 32, NW¼	Star Lake	cavity, cliff		
Burrowing Owl	6/24	T22N, R11W, S. 23, SE¼	Pueblo Bonito	hole, ground		
" "	5/21	T22N, R10W, S. 27, SW¼	Pueblo Bonito	hole, ground		
" "	5/18	T20N, R8W, S. 1, SE¼	Pueblo Pintado	hole, ground		
" "	6/2	T23N, R12W, S. 19, SE¼	Tanner Lake	hole, ground		
" "	6/6	T23N, R12W, S. 29, NW¼	Tanner Lake	hole, ground		
Ferruginous Hawk	5/7	T24N, R13W, S. 33, NE¼	Alamo Mesa West	stick, badlands		2 (6/9)[1]
" "	6/9	T23N, R12W, S. 9, NE¼	Pretty Rock	stick, tree		
" "	5/17	T23N, R12W, S. 35, NW¼	Pretty Rock	stick, badlands		
" "	6/9	T22N, R10W, S. 8, SE¼	Pueblo Bonito NW	stick, badlands		2
Red-tailed Hawk	5/3	T20N, R5W, S. 26, NE¼	Ojo Encino Mesa	stick, tree		
" "	5/7	T19N, R5W, S. 14, SE¼	Ojo Encino Mesa	stick, cliff		
" "	5/2	T20N, R6W, S. 14, SE¼	Star Lake			

Table 34. Continued

Species	Date Observed	Location	Map Reference (USGS 7.5 min. quad)	Nest Structure, Substrate	Eggs	Young
" "	5/12	T19N, R6W, S. 15	Star Lake	stick, cliff		
" "	5/2	T20N, R5W, S. 33, NW¼	Star Lake	stick, cliff		
" "	5/31	T18N, R4W, S. 32, NW¼	Tinian	stick, cliff		
" "	6/1	T18N, R4W, S. 13, SE¼	Wolf Stand	stick, cliff		
" "	6/9	T22N, R13W, S. 29, NW¼	Kin Klizhin Ruins	stick, cliff		
" "	6/9	T22N, R13W, S. 11, NW¼	Tanner Lake	stick, cliff		
" "	5/1	T21N, R7W, S. 28, SE¼	Lybrook SE	stick, cliff		
Swainson's Hawk	5/20	T23N, R11W, S. 20, SW¼	Pretty Rock	stick, tree		
Golden Eagle	5/8	T19N, R4W, S. 2, NE¼	Johnson Trading Post	stick, cliff		
" "	5/7	T22N, R8W, S. 32, NE¼	Fire Rock Well	stick, cliff		1 (6/10)[1]
" "	6/7	T22N, R11W, S. 19, NE¼	Pretty Rock	stick, cliff		1
" "	6/9	T21N, R12W, S. 27, SW¼	Kin Klizhin Ruins	stick, cliff		1
" "	5/31	T16N, R6W, S. 28, NW¼	Mesa Cortada	stick, cliff		Present
" "	5/25	T20N, R6W, S. 28, NW¼	Ojo Encino Mesa	stick, tree		2

Table 34. Continued

Species	Date Observed	Location	Map Reference (USGS 7.5 min. quad)	Nest Structure, Substrate	Eggs	Young
Prairie Falcon	6/9	T24N, R12W, S. 29, NW¼	Alamo Mesa West	cavity, dirt bank		1
" "	6/1	T18N, R4W, S. 32	Canada Calladita	stick, cliff		
" "	5/18	T22N, R13W, S. 21, SE¼	Tanner Lake	stick, cliff		4
" "	5/30	T17N, R5W, S. 36, SE¼	Canada Calladita	cavity, cliff		
" "	5/19	T21N, R10W, S. 28, NE¼	Pueblo Bonito	cavity, cliff		
" "	5/19	T21N, R10W, S. 27, NE¼	Pueblo Bonito	cavity, cliff		
" "	6/9	T22N, R13W, S. 9, NE¼	LaVida Mission	cavity, cliff		
Common Raven	5/6	T21N, R8W, S. 29, NE¼	Fire Rock Well	stick, cliff		6
" "	6/9	T23N, R12W, S. 23	Pretty Rock	stick, windmill		
" "	5/3	T20N, R5W, S. 27, SE¼	Ojo Encino Mesa	stick, cliff		
" "	5/25	T20N, R4W, S. 28, SW¼	Ojo Encino Mesa	stick, tree		
" "	5/7	T19N, R5W, S. 14, SE¼	Ojo Encino Mesa	stick, cliff		
" "	5/1	T20N, R7W, S. 10, SE¼	Pueblo Alto Trading Post	stick, power pole		
" "	5/4	T20N, R6W, S. 15, NW¼	Star Lake	stick, cliff		

Table 34. Continued

Species	Date Observed	Location	Map Reference (USGS 7.5 min. quad)	Nest Structure, Substrate	Eggs	Young
Common Raven	5/4	T20N, R5W, S. 19, NW¼	Star Lake	stick, cliff	3	1
" "	5/8	T19N, R4W, S. 1, SW¼	Johnson Trading Post	stick, cliff		
" "	6/10	T22N, R8W, S. 31, NW¼	Fire Rock Well	stick, cliff		
" "	5/2	T20N, R5W, S. 32, NE¼	Star Lake	stick, cliff		
" "	5/25	T19N, R4W, S. 18, SW¼	Tinian	stick, cliff		
" "	5/3	T19N, R4W, S. 29	Tinian	stick, cliff		
" "	5/13	T18N, R3W, S. 18, NW¼	Wolf Stand	stick, cliff		4

[1]Date of observation of young.

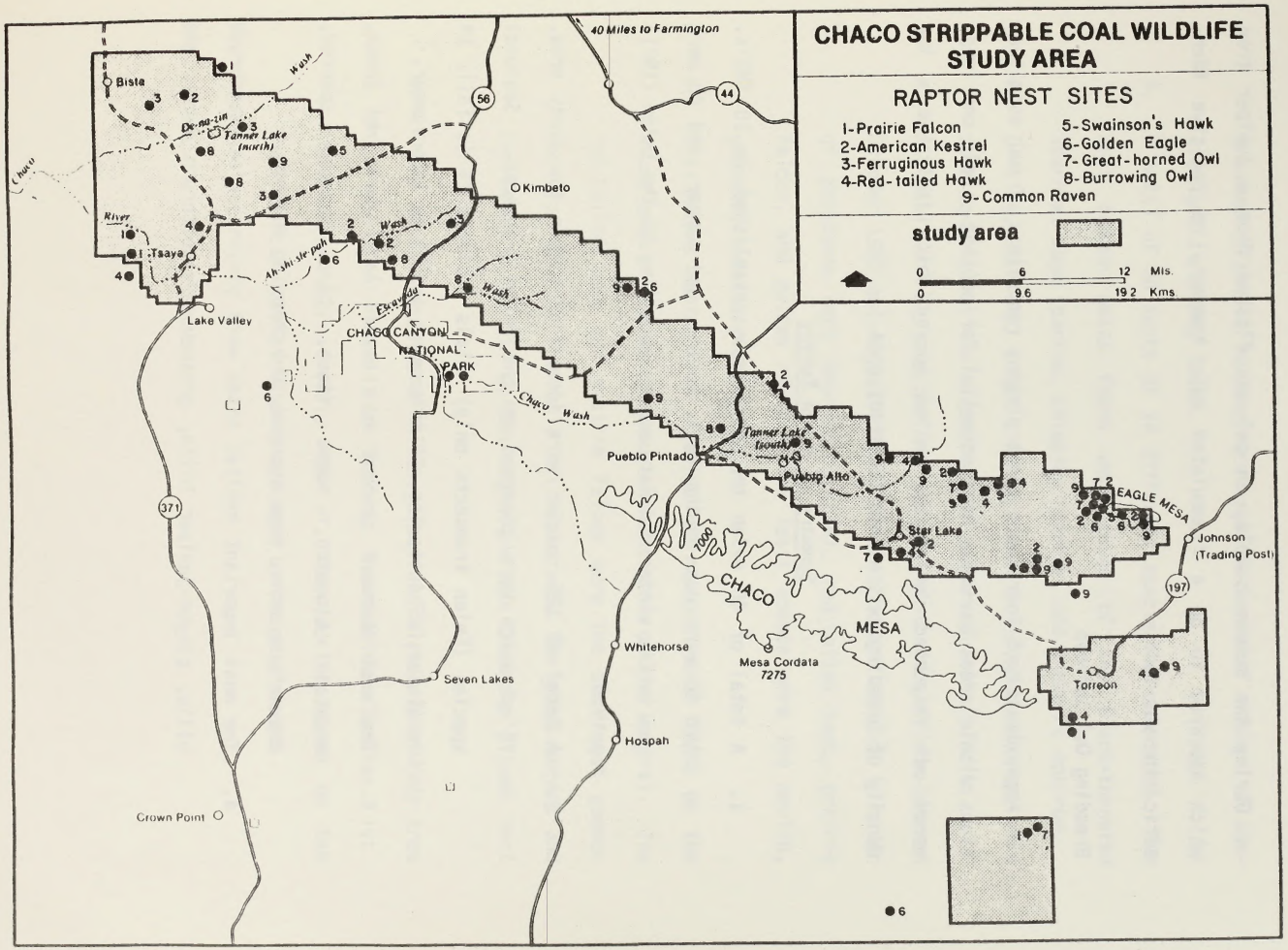
CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
RAPTOR NEST SITES
1-Prairie Falcon
2-American Kestrel
3-Ferruginous Hawk
4-Red-tailed Hawk
5-Swainson's Hawk
6-Golden Eagle
7-Great-horned Owl
8-Burrowing Owl
9-Common Raven
study area
0 6 12 Mls.
0 9.6 19.2 Kms.
40 Miles to Farmington
Bista
Tanner Lake (north)
Tsaya
Lake Valley
Kimbeto
CHACO CANYON NATIONAL PARK
Chaco Wash
Pueblo Pintado
Tanner Lake (south)
Pueblo Alto
Star Lake
EAGLE MESA
Johnson (Trading Post)
CHACO MESA
Mesa Cordata 7275
Whitehorse
Hospah
Seven Lakes
Crown Point
Torreon
56
44
371
197

Figure 14

During the summer sample, an owl was flushed from a juniper tree which appeared to be a flammulated owl; however, no positive identification was made.

Breeding Owl Surveys

Approximately 6 hours were spent playing recordings of owl vocalizations within areas having a high potential for nesting. Only one long-eared owl responded during the entire survey which indicated a low density of breeding owls within the study area.

Summary of Avian Survey

1. A total of 40 avian transects were established in 10 SHS's. All 40 were run in the fall, spring, and summer, and 20 were run in the winter and late summer according to the Emlen (1971) method.
2. A total of 125 species were identified within the study area, 78 of which were observed on the Emlen transects. Seasonal species (Emlen transects only) totals included 24 in fall, 14 in winter, 55 in spring, 56 in summer, and 33 in late summer.
3. The most abundant species were horned lark, dark-eyed junco, mountain bluebird, house finch, black-throated sparrow, Brewer's sparrow, sage sparrow, and chipping sparrow.
4. The most important habitat sites were pinyon-juniper/sagebrush hills, pinyon-juniper hills, greasewood/rabbitbrush dunes, and

greasewood/alkali sacaton drainage in terms of number of species and diversity index.

5. A total of 38 nests of 14 different species were located. The most common nests found were those of the black-throated sparrow, sage sparrow, chipping sparrow, and Brewer's sparrow.
6. Driving, walking, night calling, and helicopter surveys were used to document the occurrence of raptors and their nests.
7. A total of 17 species of raptors were identified between October 1980 and August 1981. The most common species in order of abundance were American kestrel, red-tailed hawk, prairie falcon, and golden eagle. The least common were the merlin, goshawk, and sharp-shinned hawk.
8. The active nests of 9 species of raptors were found on the study area. The most common was the nest of the kestrel. The red-tailed hawk and prairie falcon were the next most common nesting raptors. The only owl nests were the great-horned and burrowing owl. Six golden eagle and one Swainson's hawk nest were found.
9. There were 47 species of birds identified within the study area that were not listed in Task 1, Hypothetical Species List. Conversely, approximately 70% of the species shown on the Hypothetical Species List were found in the study area.

HERPETOLOGICAL SURVEY

Introduction

A systematic reptile and amphibian survey of the Chaco Strippable Coal Area was conducted during November 1980 and May and July 1981. This survey was undertaken to provide a species list and to determine the relative abundance of herpetological fauna on the study area.

All scientific and common names used in this report are those accepted by the Society for the Study of Amphibians and Reptiles Committee on Common and Scientific Names (Collins et al. 1978).

Methods

Survey efforts, both diurnal and nocturnal, were conducted in 10 identified standard habitat sites and in several "special habitat features" throughout the study area. As many as 7 representatives of each habitat site were sampled during each survey period. Attempts were made to sample representative areas of each habitat site in different locales of the study site where ever possible.

Diurnal surveys were conducted by 2 persons simultaneously walking generally parallel "transects" of varying lengths and widths within each habitat site or special feature, depending on the size and physiognomy of the area being sampled. Transect boundaries were not rigidly

defined, and searchers were not confined to specific areas other than the habitat site and associated ecotones or the special feature being surveyed. Surveys were conducted throughout the daylight hours (i.e., morning, afternoon, and evening) so that representative temporal samples of each habitat site were obtained. Variations in weather conditions sometimes necessitated changes in the sampling schedule in order to more precisely coincide with activity patterns of reptile and amphibian species.

Nocturnal surveys took the form of road hunting and samples of aquatic areas. Two paved roads (NM #371 and #9) within or immediately adjacent to the study area were slowly driven between dusk and 2400 hours. Although the primary objective was to locate nocturnal snake species, this method was also effective in locating amphibians during the summer rainy season.

During nocturnal aquatic surveys, searchers walked the perimeters of annual and perennial water bodies, locating animals with handheld spotlights.

In addition to systematic sampling, information was also obtained from incidental sightings by competent observers as well as the herpetologists. These reports were evaluated to determine authenticity and used when appropriate.

Initially, all individuals were live-captured to confirm identification and then immediately released. Increased familiarity with most species of "herptiles" made later capture and handling of individuals unnecessary. No voucher specimens were retained. Identification

followed Smith (1946), Stebbins (1951, 1966), Conant (1958), and Baxter and Stone (1980).

The capture of reptiles and amphibians generally followed methods outlined by Balgooyen (1977). Although several methods were used, those of Balgooyen proved to be the most effective for live-capturing lizards. Lizards were collected by snapping with a rubber band or shooting with .22 dust shot. Snakes were handled with a "shepherd's crook" stick or by hand. Amphibians were captured using dip nets or by hand.

During samples, the number of individuals of each species captured or observed was recorded. The number of each species from each habitat site was believed to crudely reflect the relative abundance of that species in that habitat. The location, date, time, weather conditions, site features, miles and hours of survey, as well as some data on age, sex, physical characteristics, and behavior of individuals were also recorded.

Results

The results are divided into two major categories; species accounts and habitat preference. The information gathered on the herpetofauna of the study area is presented on Table 35. The relative abundance, determined by the number of observations, is shown in Table 36. Included on Table 35 are the diversity indices calculated for each habitat site. Because of the relatively small number of species, however, the reliability of these indices is questionable. For example, the mixed shrub rolling upland had the second highest number of species (7) of any

Table 35. Species list and number of herpetofauna within 10 standard habitat sites and 10 special habitat features on the Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Standard Habitat Site										Special Features								
											Terrestrial					Aquatic			
	Greasewood/ Sand/Drush Dunes (N = 6) No. (%)	Greasewood/Alkali Sacaton Drainage (N = 4) No. (%)	Mixed Shrub Rolling Upland (N = 7) No. (%)	Sagebrush/Galleta Rolling Upland (N = 7) No. (%)	Alkali Sacaton/ Annual Atriplex Swale (N = 3) No. (%)	Snakeweed/Galleta Uplands (N = 3) No. (%)	Ricegrass/Snakeweed Dunes (N = 7) No. (%)	Pinyon-Juniper/ Sagebrush Hills (N = 6) No. (%)	Pinyon-Juniper Hills (Rock Outcrops) (N = 4) No. (%)	Badlands (Rocks) (N = 10) No. (%)	Rocks (N = 10)	Scoria Hills (N = 1)	Delapidated Dwellings (N = 3)	Sand Dunes (N = 1)	Greasewood-Tamarisk High Bank Arroyo (N = 1)	Paved Roads	Windmill Tanks (N = 4)	Natural Springs (N = 2)	Flowing Creek (N = 1)	Stock Ponds (Perennial Rain) (N = 9)
REPTILES																				
Lizards (N = 9)																				
Northern Sagebrush Lizard	70 (86)	15 (94)	129 (90)	85 (91)	13 (19)	33 (56)	94 (35)	109 (78)	16 (38)	7 (15)	26 (18)	1 (100)	7 (78)	10 (71)	30 (86)		2			
Northern Plateau Lizard	1 (1)		2 (1)			1 (2)		13 (9)	12 (29)	6 (12)	74 (52)		2 (22)		5 (14)			1		
Desert Side-blotched Lizard										28 (58)	37 (26)									
Northern Tree Lizard									8 (19)		13 (2)									
Speckled Earless Lizard	6 (8)	1 (6)	6 (4)	7 (8)	55 (80)	25 (42)	138 (52)			7 (15)				3 (22)						
Plateau Striped Whiptail			1 (1)					15 (11)			1 (1)									
Little Striped Whiptail	4 (5)		4 (3)				34 (13)							1 (7)						
Yellow-headed Collared Lizard								2 (2)	5 (12)		2 (1)									
Desert Short-horned Lizard			1 (1)	1 (1)	1 (1)				1 (2)											
Snakes (N = 6)																				
Prairie Rattlesnake			2	1			2		1		1	1	1			9			1	
Gopher Snake											1					1				1
Painted Desert Glossy Snake																3				
Desert Striped Whipsnake											2									
Wandering Garter Snake																				3
Mexican Hognose				1																
AMPHIBIANS																				
Toads (N = 2)																				
Plains Spadefoot																16	8			13
Western Spadefoot																				5
Salamanders (N = 1)																				
Tiger Salamander																9		1		7
Total Number of Species	4	2	7	5	3	3	4	4	6	4	9	2	3	3	2	5	2	2	1	5
Diversity Index	.75	.34	.77	.62	.80	1.09	1.47	1.03	2.11	1.64	1.87	0	1.15	1.09	.75	1.94	.72	.99	0	1.95

[1]Percent observed calculated only for lizard species in habitat types and terrestrial special features.

[2]Observation from an ecotone with another habitat type.

Table 36. Relative abundance[1] of herpetofauna within each standard habitat site and 10 special habitat features, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Species	Greasewood/Alkali Sacaton Drainage	Alkali Sacaton/Annual Atriplex Swale	Snakeweed/Galleta Uplands	Ricegrass/Snakeweed Dunes	Badlands	Greasewood/Rabbitbrush Dunes	Pinyon-Juniper/Sagebrush Hills	Sagebrush/Galleta Rolling Uplands	Mixed Shrub Rolling Uplands	Pinyon-Juniper Hills	Scorria Hills	Greasewood/Tamarisk High Bank Arroyo	Dilapidated Dwellings	Sand Dunes	Paved Roads	Rock Outcrops	Natural Springs	Flowing Creek	Windmills/Stock Tanks	Stock Ponds
Northern Sagebrush Lizard	M	M	C	A	U	A	A	A	A	M	U	C	U	U		M			U	
Northern Plateau Lizard			U		U	U	M		U	M		U	U			A	U			
Desert Side-blotched Lizard					M											C				
Northern Tree Lizard										U						U				
Speckled Earless Lizard	U	C	M	A	U	U		U	U					U						
Plateau Striped Whiptail							M		U							U				
Little Striped Whiptail				C		U			U					U						
Yellow-headed Collared Lizard							U			U						U				
Desert Short-horned Lizard		U						U	U	U										
Prairie Rattlesnake				U				U	U	U	U		U		U	U		U		
Gopher Snake															U	U				U
Painted Desert Glossy Snake															U					
Desert Striped Whipsnake																U				
Wandering Garter Snake																				U
Mexican Hognose Snake								U												
Plains Spadefoot															M				U	M
Western Spadefoot																				U
Tiger Salamander															U		U			U
Total Species	2	3	3	4	4	4	4	5	7	6	2	2	3	3	5	9	2	1	2	5

[1]U - Uncommon, 1-10 observations
M - Moderately common, 11-29 observations
C - Common, 30-49 observations
A - Abundant, 50+ observations

habitat site but had a low diversity index. This is in contrast to some habitat sites that had 3 or 4 species but a relatively high diversity index. This is because the number of individuals of each species is considered when calculating the index. If one species, such as the northern sagebrush lizard, is extremely abundant in relation to the other species, within the habitat site, the diversity index will be low. On the other hand, a few species with relatively equal numbers will result in a relatively high diversity index.

Species Accounts

Reptiles - Lizards

Sceloporus graciosus graciosus - Northern Sagebrush Lizard

Specimens examined or observed = 647

Locations - T23N, R12W, S. 7, 8, 18, 14, 15, 16, 19, 20, 26, 22, 23, 24, 9, 10, 30; T22N, R13W, S. 25, 28, 31; T23N, R13W, S. 14, 15, 25, 26; T22N, R9W, S. 17, 18; T20N, R7W, S. 2, 11; T18N, R4W, S. 10, 11; T19N, R3W, S. 7, 18; T23N, R11W, S. 22, 27, 30; T19N, R5W, S. 8, 11, 13, 14, 23; T18N, R5W, S. 25, 36, 32, 33; T20N, R5W, S. 19, 29, 30; T21N, R9W, S. 23; T19N, R4W, S. 1, 2, 10; T20N, R6W, S. 34; T22N, R12W, S, 4, 5, 8, 9; T24N, R13W, S. 19; T22N, R10W, S. 7; T20N, R4W, S. 34, 35, 28, 33; T19N, R6W, S. 14; T21N, R7W, S. 29

The northern sagebrush lizard was ubiquitously distributed throughout the study area in every habitat site and special feature (except aquatic areas) and in nearly every sample site (Table 34). The sagebrush lizard was generally associated with areas of dense shrub growths, sandy soils, and small mammal burrows at bases of shrubs, but it would also rely upon vegetation alone for escape cover when pressed. This was especially common in situations where windblown vegetation had collected along fence rows. Relatively few observations were associated with rocks. Douglas (1966) reports no specimens taken from open rocky areas after rocks were moderately heated by the sun.

In addition to escape cover, vegetation seems equally important to sagebrush lizards for thermo-regulatory reasons (i.e., shade for cooling). This coincides with conclusions reached by Harris (1963), Douglas (1966), and Jones (1970). Gehlbach (1965) found sagebrush lizards in the Zuni Mountains associated with generally level areas of loose clay or moderately sandy soils in pure sagebrush or saltbush-sage communities, and Douglas found them common on sand dunes and along banks of arroyos.

In studying the herpetofauna of Chaco Canyon, Jones (1970) observed that sagebrush lizards were found in all localities where the speckled earless lizard (Holbrookia maculata approximans) was found but not vice versa. He bases this difference in habitat "preference" on the ability of sagebrush lizards to use mammal burrows and the inability of the speckled earless lizard to do the same. We also found this habitat preference but frequently observed lesser earless lizards to use small

mammal burrows for escape cover, albeit the amount of time spent underground was typically of very short duration.

Sceloporus undulatus elongatus - Northern Plateau Lizard

Specimens examined or observed = 117

Locations - T24N, R13W, S. 29, 32; T18N, R5W, S. 25, 32, 33, 35, 36; T20N, R4W, S. 34, 35; T20N, R5W, S. 30; T19N, R4W, S. 1, 2; T23N, R12W, S. 16, 26; T23N, R13W, S. 25, 26; T22N, R13W, S. 13, 28; T22N, R12W, S. 4, 7, 9; T13N, R5W, S. 11, 14; T20N, R6W, S. 34; T22N, R8W, S. 31

The northern plateau lizard was the second most widely distributed lizard on the study area (Table 1). It was found in 6 habitat sites and in association with 4 special features, but its density appeared positively correlated with rocks. Jones (1970) speculated that the principal ecological requirement of this lizard was vertical or nearly vertical rock faces with a height of at least 5 feet. Douglas (1966) also observed that rocks were important to this species. Sightings in areas without rocks were of one or two individuals and were believed to be peripheral distributions, except along heavily eroded arroyos with high, steep dirt banks. Distribution does not appear to be associated with any particular species of vegetation (Douglas 1966; Jones 1970).

Holbrookia maculata approximans - Speckled Earless Lizard

Specimens examined or observed = 248

Locations - T23N, R12W, S. 7, 8, 9, 10, 14, 15, 16, 18, 19, 20, 22, 23, 24, 30; T22N, R13W, S. 25, 31; T23N, R13W, S. 14, 15, 25, 26; T19N, R3W, S. 7, 18; T19N, R5W, S. 8, 13, 14, 23; T13N, R4W, S. 10; T20N, R6W, S. 34, 35; T22N, R12W, S. 5, 8; T18N, R5W, S. 36; T24N, R13W, S. 19; T23N, R11W, S. 22, 27; T22N, R10W, S. 7; T24N, R13W, S. 19

The speckled earless lizard was observed in 8 of 10 habitat sites and 1 special feature area (Table 34). Presence in 3 habitat sites was in ecotones with more suitable habitat sites, and therefore are believed to be peripheral. The distribution of speckled earless lizards appeared to depend upon relatively open areas of sandy soils. Our observations indicated little reliance on vegetation or small mammal burrows for escape cover, although both features were used when animals were repeatedly harassed. Instead, they seem to rely on their running abilities to escape potential predators. Habitat sites with the greatest density of earless lizards showed large percentages of open ground (i.e. less than 50% vegetative ground cover). This habitat preference is undoubtedly correlated with their running escape behavior.

Uta stansburiana uniformis - Colorado Side-blotched Lizard

Specimens examined or observed = 65

Locations - T23N, R13W, S. 25, 26, 13; T22N, R13W, S. 28; T22N, R12W, S. 4, 9

The Colorado side-blotched lizard was found in only one habitat site and at one special feature. Both of these sites were ecologically similar with abundant large sandstone rocks or cliffs and were used extensively by this species. Douglas (1966) and Jones (1970) found Uta present only in association with and never venturing from rocks.

We found side-blotched lizards most dense in areas of reddish brown sandstone rocks or cliff faces. Uta in these areas were so cryptically colored that individuals frequently went undetected until they flushed in response to our presence. Douglas (1966) observed that the coloration of Mesa Verde Uta very closely approximated the color of its habitat.

Our observations showed that the distribution of side-blotched lizards in the study area did not coincide with that of the northern tree lizard (Urosaurus ornatus wrighti, see below) as found by Douglas (1966) in Mesa Verde National Park. Although the prime ecological requirement of both species appears to be rocks, side-blotched lizards were found only in the northern portion and tree lizards in the southern portion of the study area. Whether this distribution pattern is correct or simply reflects insufficient sampling is unknown.

Urosaurus ornatus wrighti - Northern Tree Lizard

Specimens examined or observed = 11

Locations - T19N, R4W, S. 1, 2 (Eagle Mesa); T18N, R5W, S. 25, 35, 36 (Chaco Mesa); T19N, R5W, S. 11 (Little Blue Mesa)

The northern tree lizard was the least common lizard observed on the study area. We found it only at 3 sampling sites (all 3 on mesas) of 2 habitats. As with Uta, tree lizards appear to be restricted to rocky areas but are also found in association with pinyon pine (Pinus edulis). Jones (1970) found similar habitat affinities. We observed no tree lizards utilizing trees.

Cnemidophorus inornatus arizonae - Arizona Striped Whiptail

Specimens examined or observed = 42

Locations - T23N, R12W, S. 7, 8, 10, 18, 30; T23N, R13W, S. 14, 15, 25, 26; T23N, R11W, S. 30; T24N, R13W, S. 19

The Arizona striped whiptail was observed in 3 habitat sites and at 1 special feature (Table 34). It was distributed in the northern part of the study area extending no farther south than the Ah-shi-sle-pah Wash.

The most salient ecological feature common to all 4 habitat sites was sandy soils. Arizona striped whiptails were most dense in the

snakeweed-ricegrass habitat and least dense in pure sand dunes. Although this species used some of the same habitat sites as the plateau striped whiptail (C. velox), we observed no sites where they existed sympatrically.

Cnemidophorus velox - Plateau Striped Whiptail

Specimens examined or observed = 17

Locations - T18N, R5W, S. 32, 33; T20N, R5W, S. 30; T20N, R4W, S. 28, 33, 34, 35; T21N, R7W, S. 29; T22N, R13W, S. 13

Plateau striped whiptails were observed in 2 habitat sites and 1 special feature area. However, 88% (N = 15) of all observations came from the pinyon-juniper/sagebrush habitat site. This agrees with findings of Wright and Lowe (1968). By contrast, Jones (1970) found C. velox inhabiting alluvial canyon bottoms in association with greasewood, rabbitbrush, four-wing saltbush, and tumbleweed in Chaco Canyon National Monument. We visited Jones' study area and found this to be the case, yet we were able to make only one observation of C. velox in this type of habitat outside of Chaco Canyon National Monument.

Crotaphytus collaris auriceps - Yellowhead Collared Lizard

Specimens examined or observed = 9

Locations - T21N, R7W, S. 29; T19N, R4W, S. 1, 2; T18N, R5W, S. 35, 36; T21N, R8W, S. 5

The yellowhead collared lizard was observed in 4 samples of 2 habitat sites and 1 special feature. Seven of nine sightings came from pinyon-juniper community. All but 2 sightings were associated with rocks under which the individuals would retreat when approached. Both Douglas (1966) and Jones (1970) observed collared lizards in association with rocky ledges, above cliffs, on talus slopes, and in open brush areas at edges of cliff faces.

Although locally abundant, collared lizards are believed to be distributed at low densities in suitable habitat throughout the study area.

Phrynosoma douglassi ornatissimum - Desert Short-horned Lizard

Specimens examined or observed = 4

Locations - T23N, R12W, S. 19, 30; T19N, R5W, S. 14; T18N, R5W, S. 35

The desert short-horned lizard was observed 4 times in 4 different habitat sites. It should not be concluded, however, that they occur

only in these 4 habitats. Douglas (1966) believes horned lizards in the Mesa Verde region can be found in a wide variety of habitats, and we agree. We would not be surprised to find horned lizards in any of the 10 habitat sites or 6 terrestrial special feature areas, albeit at low densities.

Reptiles - Snakes

Crotalus viridis viridis - Prairie Rattlesnake

Specimens examined or observed = 18

Locations - T23N, R11W, S. 30; T23N, R13W, S. 14; T24N, R13W, S. 19; T19N, R4W, S. 1; T23N, R12W, S. 18; T22N, R13W, S. 13, 23; T21N, R9W, S. 18; T21N, R13W, S. 11, 2, 22

Prairie rattlesnakes were observed in 4 habitat sites, at 2 special features, and especially while road hunting. Rattlesnakes were observed slightly more in mixed shrub and snakeweed-ricegrass habitat sites than elsewhere. Jones (1970) found Chaco Canyon prairie rattlesnakes occupying ecotonal zones between mixed shrub and saltbush-greasewood communities in a rabbitbrush community and in mixed grasslands. This species is believed distributed at low densities throughout the study area.

Pituophis melanoleucus - Gopher Snake

Specimens examined or observed = 3

Locations - T19N, R5W, S. 11; T20N, R7W, S. 19

Three gopher snakes were observed during the study; one was located in a rocky mesa ledge, one road-killed in a mixed shrub habitat site, and one observed swimming across a perennial, rain-filled stock-pond (Table 34). Because of this small sample size, habitat affinities cannot be determined. Both Jones (1970) and Douglas (1966) state that gopher snakes were probably the most common snake on their study areas and that they occupied a wide variety of habitats. This is likely the case for this study area also.

Subspecies identification was not made during this study because specimens examined appear to be intergrades between the Great Basin (P. m. deserticola) and Sonoran (P. m. affinis) types. Diagnostic characteristics for either subspecies were unclear. This phenomenon has been reported by Gehlback (1965) in the Zuni Mountains, by Harris (1967) in the Chuska Valley, by Dean and Stock (1961) in the Navajo Reservoir Basin, and by Jones (1970) in Chaco Canyon National Monument. Farther north in Mesa Verde, Douglas (1966) reported collecting P. m. deserticola.

Arizona elegans phillipi - Painted Desert Glossy Snake

Specimens examined or observed = 2

Locations - T22N, R13W, S. 13, 35

The painted desert glossy snake was found road-killed on 2 occasions near Tsaya Trading Post, San Juan County. Both specimens were located in areas where the highway went through a sandy snakeweed-galleta habitat site. One was within the study area boundaries and the other within 1 mile.

As of 1970, observations of the painted desert glossy snake in San Juan County, New Mexico, had been reported only 3 times (Harris 1967; Jones 1970). Apparently all 3 specimens were collected in small, sandy washes.

Masticophis taeniatus taeniatus - Desert Striped Whipsnake

Specimens examined or observed = 2

Locations - T22N, R12W, S. 9; T22N, R8W, S. 31

Two sightings of desert striped whipsnakes were recorded. One was a road-kill along an unimproved gravel road near a rocky outcrop, and the other was observed below a rocky ledge along a mesa top. Rocks appear to be an important ecological feature for this species. Douglas (1966)

reports that mesa tops in pinyon-juniper woodlands and moist secondary canyons as important habitat. Jones (1970) observed alluvium canyon floors near rincons of saltbush-greasewood or rabbitbrush communities as whipsnake habitat. Our findings, although limited by a small sample size, do not disagree with the literature.

Thamnophis elegans vagrans - Wandering Garter Snake

Specimens examined or observed = 3

Locations - T21N, R9W, S. 18

The wandering garter snake was observed 3 times at only one location--a perennial, rain-filled stock pond along Gallo Wash approximately 4.8 km northeast of Sargent Ranch. This stock pond is located in an area dominated by rabbitbrush. All three specimens were observed nocturnally, floating amongst aquatic vegetation within 1 m of shore.

Jones (1970) mentioned collecting 2 individual wandering garter snakes from a stock pond along Gallo Wash and noted that his specimens represented the first recorded occurrence of T. e. vagrans in this area (Harris 1963). Our sightings may well come from the very same stock pond and add greatly to the evidence that the range of T. e. vagrans should be extended to include this area.

Heterodon nasicus kennerlyi - Mexican Hognose Snake

Specimens examined or observed = 1

Locations - T19N, R4W, S. 10

The Mexican hognose snake was observed only once during our herpetological survey. This observation was made along a small, lightly eroded wash in a sagebrush habitat site near the southern boundary of the study area. The specimen was captured and examined to assure proper identification. To our knowledge, it is the first documented observation of this species in northwestern New Mexico. Although published range maps in field guides are generally not very precise, neither Stebbins (1966) nor Behler (1979) show H. n. kennerlyi to range in this area. An unverified sighting and photograph was brought to our attention by a Chaco Canyon National Monument ranger (J. Miller, seasonal ranger, personal communication, 1981) yet Jones (1970) makes no mention of this species in Chaco Canyon National Monument.

Amphibians - Toads

Scaphiopus bombifrons - Plains Spadefoot

Specimens examined or observed = 37 adults, numerous larvae

Locations - T22N, R12W, S. 4, 5, 7; T23N, R13W, S. 24; T23N, R12W, S. 10, 17, 20; T18N, R5W, S. 25; T21N, R13W, S. 2, 11, 15; T20N, R7W, S. 1, 2, 29, 34, 35

The majority of adult S. bombifrons were observed between July 12-15. These observations immediately followed 2 nights of extremely heavy rainfall which filled or partially filled numerous stock ponds throughout the study area. Nocturnal surveys of aquatic areas during this period showed males to be actively engaged in courtship behavior (i.e., breeding vocalizations and territorial delineation and maintenance). Male S. bombifrons were observed vocalizing while clinging to partially submerged vegetation within 5 cm of shore. Males seemed to respond in kind to the vocalization intensity of conspecifics. Jones (1970) found similar behavior in plains spadefoots in Chaco Canyon National Monument. Some females were observed being bred.

Tadpoles were sampled throughout the July survey and were found in numerous stock ponds throughout the study area. Morphologically distinct individuals were observed in ponds in the extreme northern portion of the study area on July 13 and 14. These ponds had apparently filled earlier than those with breeding adults described above. Type III individuals (Bragg and Bragg 1958) were observed in ponds sampled on July 24 in the southern portion of the study area. These observations indicate that S. bombifrons breeding in the study area was probably in response to local precipitation conditions than to season.

Some adults (N = 16) were observed while nocturnally road-hunting paved roads after rains. These individuals were believed to be foraging for insects along the pavement, a behavior described for this species by Baxter and Stone (1980).

Scaphiopus hammondi - Western Spadefoot

Specimens examined or observed = 5 adults

Locations - T22N, R12W, S. 7

Western spadefoot toads were observed at only 1 location on the study area. This was a recently rain-filled stock pond. All 5 individuals were adult breeding males actively engaged in courtship vocalizing. Males were observed free floating near the middle of the pond.

Jones (1970) found S. hammondi to outnumber S. bombifrons between 7:1 to 10:1 in Chaco Canyon National Monument. By contrast, we found S. bombifrons to outnumber S. hammondi at this site by 2-3:1. In addition, no individuals were observed while road hunting. No reason is apparent for the low density of S. hammondi at this particular site or throughout the study area since they appear so numerous in Chaco Canyon National Monument.

Ambystoma tigrinum - Tiger Salamander

Specimens examined or observed = 17 adults, numerous larvae

Locations - Adults: T20N, R4W, S. 33 (Eagle Spring); T21N, R13W, S. 2, 11; Larvae: T21N, R9W, S. 18; T22N, R12W, S. 24; T20N, R4W, S. 33

Tiger salamanders were observed in a variety of habitats. One large adult was observed in Eagle Spring, and 16 adults were observed after rains along paved roads in mixed shrub, snakeweed-galleta, and sagebrush habitat sites. Larval forms were observed at Eagle Spring, and at 2 stock ponds. It is noteworthy that we observed no larval Scaphiopus in stock tanks which harbored larval A. tigrinum. This phenomenon was also observed by Gehlbach (1965) and Jones (1970) and is probably related to the carnivorous nature of A. tigrinum.

Subspecies determination was not made for this species because the taxonomic status is currently unclear. We suspect, however, all but one individual to be of the subspecies A. t. utahense (Lowe) although characteristics seemed to blend with those of A. t. mavortium and A. t. nebulosum. The single adult found at Eagle Spring appeared more characteristic of A. t. melanostictum.

Species of Possible Occurrence

Range maps presented by Stebbins (1966) and Behler and King (1979) indicate the possible occurrence of the following reptile and amphibian species: Sceloporus magister, Desert Spiny Lizard; Uta stansburiana stejnegeri, Desert Side-blotched Lizard; Cnemidophorus tigris, Western Whiptail; C. tesselatus, Checkered Whiptail; Eumeces multivirgatus, Many-lined Skink; Gambelia wislizenii, Leopard Lizard; Hypsiglena torquata, Night Snake; Thamnophis cyrtopsis, Black-necked Garter Snake; Masticophis flagellum, Coachwhip; Bufo punctatus, Red-spotted Toad; Bufo woodhousei australis, Southwestern Woodhouse's Toad; Scaphiopus

intermontanus, Great Basin Spadefoot; Rana pipiens, Leopard Frog; Hyla arenicolor, Canyon Tree Frog; Terrapene ornata ornata, Ornate Box Turtle.

Brand et al. (1937) reported Bufo sp. and Rana pipiens present in the Chaco area. Harris (1967) collected Rana catesbeiana, R. pipiens, Bufo woodhousei and B. punctatus 20 miles away from Chaco Canyon (San Juan County). Gehlbach (1965) found B. woodhousei, Hyla arenicolor, Rana pipiens, and Scaphiopus intermontanus near Thoreau (McKinley County). Jones (1970) collected 1 Terrapene ornata and 1 Hypsiglena torquata in Chaco Canyon National Monument. In the case of T. ornata, Jones believes it was introduced.

Habitat Relationships

The diversity of physiographic characteristics on the Chaco Strippable Coal study area has profoundly influenced vegetation. This can be observed in the number and distribution of distinct habitat sites and less distinct plant communities at certain physiographic features (e.g., cliffs, sand dunes, etc.). Ten habitat sites and certain physiographic features were examined to determine what effects they have on the distribution of herpetofauna.

Habitat Sites

Greasewood-Rabbitbrush Dune

Four representative sites were sampled 6 times and yielded observations of 4 lizard species (Table 34). The sagebrush lizard was observed more (N = 70, 86% of observations) than other species. The speckled earless lizard was the next most frequently observed species (N = 6, 8%), followed by the Arizona striped whiptail (N = 4, 5%), and the northern plateau lizard (N = 1, 1%). Observations of earless lizards were confined to ecotones with the alkali sacaton habitat site. The one observation of a plateau lizard was on a high dirt bank along an arroyo.

Greasewood/Alkali Sacaton Drainage

The greasewood drainage habitat site was found at 4 locations on the study area, and each site was sampled once. Only 2 species of reptiles were observed and these at very low densities (Table 34). Observations of the sagebrush lizard accounted for 94% (N = 15) of sightings. The only other species observed was 1 sighting of the speckled earless lizard; this was in an ecotonal area with the snakeweed-galleta habitat site.

Considering the number of hours (N = 8) and miles (N = 12) expended in surveying this habitat site, the 16 sightings of two species indicate an extremely low density and diversity of herpetofauna using this habitat. The sagebrush lizard appears to be the only reptile species capable of exploiting this habitat site on a sustained basis.

Mixed Shrub Rolling Uplands

Samples taken in the mixed shrub habitat site (N = 7 samples at 7 locations) yielded observations of 7 species, the second highest number of species of any habitat site sampled. The sagebrush lizard accounted for 90% of all observations (N = 129). The speckled earless lizard was next most common (N = 6, 4%), followed by the Arizona striped whiptail (N = 4, 3%), the northern plateau lizard (N = 2, 1%) and single sightings of the plateau striped whiptail and the desert short-horned lizard. Prairie rattlesnakes were observed on 2 occasions.

Big Sagebrush/Galleta Rolling Uplands

Samples in the sagebrush habitat site (N = 7) yielded observations of 3 lizard species and 2 snake species (Table 34). The northern sagebrush lizard dominated this habitat site; 91% of all sightings (N = 144) were of this species. The speckled earless lizard was observed 7 times (8%) on only 2 of the 7 sample sites. Single observations were made of the desert short-horned lizard, the prairie rattlesnake, and the Mexican hognose snake.

Alkali Sacaton/Annual Atriplex Swale

Three species of lizards were observed in 6 samples of this habitat site. The speckled earless lizard was most commonly observed (N = 55, 80%), followed by sagebrush lizards (N = 13, 19%), and 1 sighting of the desert short-horned lizard.

This habitat site is 1 of only 3 where observations of the northern sagebrush lizard did not exceed those of all other species in that habitat site.

Snakeweed/Galleta Uplands

Three samples of 2 representative sites produced observations of 3 lizard species. The northern sagebrush lizard was slightly more frequently observed than the speckled earless lizard (N = 33, 56% and N = 25, 42%, respectively). One observation of the northern plateau lizard was also made, but its presence here was believed accidental.

Snakeweed/Ricegrass Dunes

The speckled earless lizard was observed most frequently in 7 samples of 4 representative sites (N = 138, 52%, Table 34). The northern sagebrush lizard was second (N = 94, 35%), followed by the Arizona striped whiptail (N = 34, 13%). Prairie rattlesnakes were observed twice. This particular habitat site was confined to the northern portion of the study area and produced the greatest densities of lizards observed on any habitat sites sampled.

Pinyon-Juniper/Sagebrush Hills

Four species of lizards were observed during 6 samples of 5 representative sites. The northern sagebrush lizard was observed more than other species (N = 109, 78%). The plateau striped whiptail was second

most frequently observed (N = 15, 11%), followed closely by the northern plateau lizard (N = 13, 9%). Collared lizards were observed twice (N = 2, 2%).

Pinyon-Juniper Hills (and associated rock outcrops)

Four samples of 3 representative sites produced 42 observations of 6 species. None of the 6 species were very numerous, but the northern sagebrush lizard accounted for 38% (N = 16) of the observations followed by northern plateau lizards (N = 12, 19%), northern tree lizards (N = 8, 19%), collared lizards (N = 5, 12%) and single observations of a desert short-horned lizard and a prairie rattlesnake.

Badlands (Rocks)

Ten samples of 10 representative sites yielded observations of 4 lizard species. The Colorado side-blotched lizard was most frequently observed (N = 28, 58%), followed by 7 observations (15%) of both northern sagebrush lizards and speckled earless lizards. The northern plateau lizard was observed 6 times (12%). The observations of sagebrush and earless lizards came from ecotonal areas with an alkali sacaton habitat site and neither are believed to utilize the pure badland habitat site to any great degree.

Special Features

Rocks

This special feature included rocky outcrops, mesa rimrock, boulders, and cliffs. Ten representative sites were intensively examined during the study and yielded observations of 9 reptiles (6 lizards, 3 snake species). We found this special feature to be the most diverse of all sites (habitat sites and special features) sampled.

The northern plateau lizard was most frequently observed (N = 74, 52%; Table 34), followed by the Colorado side-blotched lizard (N = 37, 26%), the northern sagebrush lizard (N = 26, 18%), the northern tree lizard (N = 3, 2%), the collared lizard (N = 2, 1%), 2 desert striped whipsnakes, and single observations of a plateau striped whiptail, a gopher snake, and a prairie rattlesnake. The observation of the plateau striped whiptail was believed peripheral.

Scorria Hills

One sample of this special feature produced only 2 observations of 2 species: a northern sagebrush lizard and a prairie rattlesnake.

Delapidated Dwellings

Three samples of this feature yielded 7 observations of northern sagebrush lizards, 2 of northern plateau lizards, and 1 prairie rattlesnake.

Sand Dunes

One sample produced observations of 3 lizard species. The northern sagebrush lizard was observed 10 times, the speckled earless lizard 3 times, and the Arizona striped whiptail once.

Greasewood-Tamarisk-High Bank Arroyo

Two species of lizards were observed in 1 sample of this feature. Observations of northern sagebrush lizards were most numerous (N = 30); northern plateau lizards were observed 5 times.

Paved Roads

Paved roads were included as a special feature because of the propensity of certain species (particularly nocturnal snakes and amphibians) to actively seek out and utilize this feature for both foraging and thermoregulation. Surveying roads allows for effective sampling of large areas and numerous habitat types which are intersected by these roads.

In 417 miles and 31.25 hrs. of nocturnal road-hunting, 3 species of snakes and 2 species of amphibians were observed (Table 34). Included in these observations are prairie rattlesnakes, 1 gopher snake, painted desert glossy snakes, tiger salamanders, and plains spadefoot toads.

Aquatic Areas

Aquatic areas surveyed were categorized into 4 types: windmill tanks, natural springs, flowing creeks, and stock ponds.

1) Windmill Tanks - Four samples of this feature yielded 8 observations of plains spadefoots within one 3 ft. high metal stock tank. How they managed to gain access is unknown. Two observations of sagebrush lizards using burrows underneath metal stock tanks were also made.

2) Natural Springs - Two surveys of natural springs produced observations of 1 adult and numerous larval forms of tiger salamanders in Eagle Spring.

3) Flowing Creek - One survey of the only flowing creek located produced 1 observation of a prairie rattlesnake along its grassy bank.

4) Stock Ponds - Nine surveys of perennial, rain-filled stock ponds produced observations of 2 snake, 2 toad, and 1 salamander species. These observations included 1 gopher snake, 3 wandering garter snakes, 13 plains spadefoot toads, 5 western spadefoot toads, and 7 larval tiger salamanders.

Discussion

The Chaco Strippable Coal Area is located within a transitional area between the Colorado Plateau and Lower Basin and Range physiographic regions. Kuchler's Associations include juniper-pinyon woodland, juniper-steppe woodland, Great Basin sagebrush, saltbush-greasewood,

desert, grama-galleta steppe, and sagebrush steppe. The fauna is characteristic of Bailey's (1913) Upper Sonoran zone.

Diverse physiographic conditions have greatly influenced the composition and distribution of vegetative communities within the study area. Ten habitat sites, each with its distinct complement of plants, characterize the study site. In addition, certain physiographic features or human disturbances to the environment have produced special habitat features best described individually.

The distribution of herpetofauna within the study area is directly related to physiography of the area and the ecological requirements of each species and less directly to the distribution of plant communities. As with all animal species, niche requirements determine where that species can or cannot reside.

Differences in ecological requirements were most apparent in ground-dwelling lizards. Five species of lizards were classified as ground-dwellers (northern sagebrush, speckled earless, desert short-horned, and Arizona and plateau striped whiptails) and four species as rock-dwellers (northern plateau, Colorado side-blotched, northern tree lizard, and yellow-headed collared lizard).

The distribution of ground-dwelling lizards appeared primarily dictated by substrate. This applied most rigidly to the speckled earless and the Arizona striped whiptail lizards. These two species were found <u>only</u> on loose, sandy soils. The ubiquitous northern sagebrush lizard, although found primarily on sites with loose, sandy soils, was not restricted to these sites. It was frequently observed using areas of hard soils (i.e., greasewood drainage and alkali sacaton habitat

sites) and rocky substrates (i.e., pinyon-juniper-rocks habitat site, and rocks and scorria hills special features). This also applied to the distribution of the plateau striped whiptail which was observed primarily on sandy soils in the pinyon-juniper-sagebrush habitat site but was also observed in the special feature rocks. Jones (1970) found C. velox to inhabit hard-pan, disclimax soils throughout Chaco Canyon.

The desert short-horned lizard was unique in that it used ground habitats of all sites (Jones 1970). Although our observations were limited, we found horned lizards on loose, sandy soils, hard soils, and on rocky substrates.

It should be noted that the distribution of the two Cnemidophorine species also appears related to geography. C. inornatus was observed only in the northern portion of the study area while C. velox was observed only in the central and southern portions. Although C. inornatus was found in greasewood-rabbitbrush dune and mixed shrub habitats, it was considerably more numerous in the snakeweed-ricegrass site, found only in northern parts of the study area. Likewise, C. velox was observed in a mixed shrub habitat site and a rock special feature but was most numerous in the pinyon-juniper-sagebrush site found mostly in the southern part of the study area. Range maps (Stebbins 1966; Behler and King 1979) show C. inornatus to be at the southeastern edge of their range in northwestern New Mexico.

Distribution of the 4 rock-dwelling species appears dependent on the size of rocks being used. The northern plateau lizard, the most frequently observed rock-dweller, was primarily associated with cliff faces, large boulders and ledges.

Observations of this species not in association with rocks were made in greasewood-rabbitbrush dune, mixed shrub, snakeweed-galleta, and pinyon-juniper-sagebrush habitat sites as well as at special features such as delapidated dwellings and greasewood-tamarisk-high bank arroyo. All observations but those from the pinyon-juniper-sagebrush habitat site and the high bank arroyo were few (N = 6) and are believed peripheral. Those from the pinyon-juniper-sagebrush habitat were made very near rocky ledges (within 10 m), and 4 individuals were observed climbing juniper trees. Sightings in the high bank arroyo feature were of individuals sunning on high steep, dirt banks of heavily eroded arroyos. These banks may be ecological equivalents of rock walls.

The Colorado side-blotched lizard was most frequently observed using more broken, rocky areas of boulders less than 10 cm in diameter. Some overlap in habitat utilization between the side-blotched and northern plateau lizard was observed (i.e., Uta using rock walls, and larger boulders). Competition, however, seems minimal since both species were seen sunning and foraging in close proximity, and no interspecific agonistic encounters were observed. Douglas (1966) believes a "tolerance" or "compatibility" exists between the northern plateau lizard and other rock dwelling lizard species. Perhaps the larger size of the plateau lizard allows it to exploit a different niche than sympatric species.

The northern tree lizard, observed only 11 times, all in the southern part of the study area, appeared to be on the periphery of its range. Jones (1970) believes this is the case for the Chaco Canyon area. We found the tree lizard to exploit basically the same habitat as the Colorado side-blotched lizard.

The yellow-headed collared lizard appeared to rely on rocks the least of these 4 species. Although observed basking on or retreating under rocks, it was also observed sitting atop sagebrush plants up to 40 m away from the nearest rock.

The habitat requirements of snakes, in general, are less easily defined because of limited observations; snakes are not a highly visible group of vertebrates and have a low probability of observation. The wandering garter snake appears confined to aquatic environs in the study area, but our observations from other states indicate this may not always be the case. The desert striped whipsnake was associated with rocky areas, and data collected by Douglas (1966) and Jones (1970) concur. The painted desert glossy snake, observed twice while road hunting, appears associated with open, sandy soils of the snakeweed-galleta habitat site. Prairie rattlesnakes were observed in several different habitat sites and at several special features. Gopher snakes were seen in a rocky area, a mixed shrub habitat site and at a rain-filled stock pond. Both the prairie rattlesnake and the gopher snake are capable of exploiting a variety of habitats and potentially may occur anywhere in the study area. The one Mexican hognose snake observed was in a sagebrush habitat site, but this lone observation is insufficient to speculate on its habitat requirements. Its presence is noteworthy, however, since it constitutes a range extension for this species.

The distribution of study area amphibians appears related to both substrate and water. All three forms of amphibians estivate for long periods of time below ground, surfacing only when moisture conditions are right for breeding and foraging activities. Substrate is important,

especially for spadefoots, which frequently dig their estivation burrows. Tiger salamanders may rely more on burrows dug by other animals for estivation.

Standing water is essential for successful reproduction by all three species. Ecological differences in breeding habitat is only apparent for the plains and western spadefoot toads. Breeding male S. bombifrons generally vocalize while grasping submerged or partially submerged vegetation within 2 m of shore while S. hammondi vocalize while free-floating generally near the center of the pond.

We suspect widespread distribution of all 3 species of amphibians in the study area, albeit at overall low densities. Locally high densities may be common around potential breeding habitat (i.e., intermittently filled stock tanks or drainages).

Although no strong relationships between herpetofauna and plant species were observed, analysis of species associated with particular habitat sites provide useful management information by indicating relative abundance and diversity in specific habitats. The greasewood-rabbitbrush dune habitat site was occupied by northern sagebrush, Arizona striped whiptails, speckled earless, and northern plateau lizards, although the latter 2 species only in ecotones with other habitat sites. The greasewood drainage site provides habitat primarily for the northern sagebrush lizard, although ecotones may allow speckled earless lizards also to use this site. This site has the fewest species and the lowest density of herpetofauna of all habitat sites. In contrast, the mixed shrub habitat site, with its diverse complement of shrubby and understory plants, showed an equally diverse herpetofauna.

All but three of the total nine lizard species were found to occur here. Those missing were the Colorado side-blotched, northern tree, and yellow-headed collared lizard; all three were primarily associated with rocks. Prairie rattlesnakes also occurred here. The sagebrush habitat site was predominately utilized by northern sagebrush lizards and to a much lesser degree by speckled earless and desert short-horned lizards. Prairie rattlesnakes were also present. The alkali sacaton habitat site supported the same lizard species as the sagebrush site, but the abundance of the northern sagebrush and the speckled earless lizards were reversed. The snakeweed-galleta habitat site showed northern sagebrush and speckled earless lizards to be nearly equally abundant and the northern plateau lizard to be a peripheral occupant. The snakeweed-ricegrass site showed the highest lizard densities of any habitat site. The speckled earless lizard was the most abundant, followed closely by the northern sagebrush lizard and then the Arizona striped whiptail. Also present were prairie rattlesnakes. The pinyon-juniper/sagebrush habitat site was occupied by northern sagebrush, plateau striped whiptail, northern plateau, and collared lizards. Sagebrush lizards were the predominant species. The pinyon-juniper (rocks) site had the second highest number of species (N = 6). Species included northern sagebrush, northern plateau, northern tree, yellow-headed collared, and desert short-horned lizards, and prairie rattlesnakes. The badland (rock) habitat site had four lizard species in residence: Colorado side-blotched (most numerous), northern plateau, northern sagebrush, and speckled earless. The latter two species came from ecotones with alkali sacaton habitat sites.

The special feature rocks support the greatest number of species of all sites sampled. Six of nine lizard species were present; those absent were speckled earless, Arizona striped whiptail, and desert short-horned lizards. Three snake species observed were prairie rattlesnakes, gopher snakes, and desert striped whipsnakes.

The remainder of the special features were sampled too few times to provide useful information other than species occurrence.

Summary

1. Reptiles and amphibians were diurnally and nocturnally surveyed during May and July of 1981.
2. Ten distinct habitat sites and 6 terrestrial and 4 aquatic special features were surveyed.
3. Nine species of lizards, 6 species of snakes, 2 species of toads, and 1 species of salamander were observed.
4. The rocky area special feature produced the largest number of reptilian species (N = 9) of all sites sampled.
5. The mixed shrub habitat site supported the greatest number of reptilian species (N = 7) while the greasewood drainage supported the lowest of all habitat sites surveyed.
6. The density of lizard species was greatest on the snakeweed-ricegrass habitat site and lowest on the greasewood drainage.
7. The distribution of lizards appeared related to substrates and the distribution of amphibians to substrate and availability of water. The mechanisms which control distribution of snakes remain unclear.

8. The 18 species of reptiles and amphibians identified within the study area represent 38% of the species included in Task 2, Hypothetical Species List.

TASK 6 - SCALED QUAIL HABITAT EVALUATION

Literature Review

Published literature concerning the ecology of scaled quail (*Callipepla squamata*) in northwestern New Mexico was not discovered during the literature search. All of the literature reviewed originated from studies conducted in Texas, Oklahoma, Arizona, and eastern and southern New Mexico.

The earliest and one of the most comprehensive studies of scaled quail was conducted by Russell (1932) in New Mexico. Although his distribution map and description includes the northwestern part of the state, none of his data were collected there. Other studies conducted in New Mexico include Borden (1973), Banks (1970), Sawyer (1973), Davis et al. (1975), and Griffing (1972). Schemnitz (1961) and Wallmo (1956) conducted comprehensive studies of scaled quail in the Oklahoma panhandle and west Texas, respectively.

One item of agreement among all authors was the utilization of a wide range of habitat types as long as suitable cover is available, whether it be manmade or natural. Heavy woodlands, however, are strictly avoided (Bailey *In* Wallmo 1956).

Although the birds will use a variety of shrubs for cover, they prefer plants which will provide good overhead protection. Mesquite (*Prosopis juliflora*) was, by far, the most important source of cover in

most studies, with plants of .5 to 2.0 meters in height most commonly used (Sawyer 1973, Banks 1970, Goodwin and Hungerford 1977). Skunkbush (Rhus trilobata), sandsage (Artemisia filifolia), yucca (Yucca sp.), and wolfberry (Lycium pallidum) were also important cover plants in Arizona and Oklahoma (Schemnitz 1961, Goodwin and Hungerford 1977). It is interesting to note that none of the studies reviewed included canopy cover measurements in the vegetation analysis.

Food habits information from each study showed the primary food to be seeds of annual and perennial forbs. Little use was made of grasses and shrubs with the exception of snakeweed (Xanthocephalum sarothrae) and mesquite (Russell 1932, Wallmo 1956, Schemnitz 1961, Banks 1970, Sawyer 1973, Davis et al. 1975). Most of the forbs eaten by quail would be considered "weeds" by many range managers since they are of little value to livestock. Examples of common foods include pigweed (Amaranthus sp.), croton (Croton sp.), sunflower (Helianthus spp.), aster, and Russian thistle (Salsola kali).

The question of whether scaled quail require drinking water still remains unanswered. Willard (In Bent 1932) noted scaled quail in Arizona inhabiting an area about 12 km from the nearest water. Russell (1932) reported that in New Mexico it was not unusual to find scaled quail 16 to 26 km from water. Wallmo (1956) observed winter coveys 5 and 11 km from water in Big Bend National Park, Texas. Schemnitz (1961) reported that scaled quail were found closer to water during the winter than any other season (2 km). Banks (1970) observed quail never more than 3 km from known water.

Methods

The initial step in evaluating the habitat for scaled quail was a determination of their distribution within study area and major vegetation types most often used. Observations of quail were recorded on BLM Form 6610-2, Wildlife Observation Report.

Measurements of the vegetation were taken to determine percent canopy cover, average height, plant species frequency, and vertical structure of cover. The Daubenmire (1959) technique, with some modification, was used to measure percent cover and plant species frequency. The plot size was increased from 20 x 50 cm to 50 x 100 cm in hopes of obtaining more accurate measurements of shrubs. A total of 40 plots were measured along four 1000 m transects established in each of 10 standard habitat sites.

The vertical structure of cover was measured using the concepts presented by Nudds (1977). This technique measures the amount of cover at predetermined heights (strata) above the ground using a "vegetation profile board." The profile board used by Nudds (1977) was 2.5 m in height and marked in alternate colors, black and white, at 0.5 m intervals. Our board was also 2.5 m in height but the intervals were .25 m of alternating black and white. It was felt that the smaller intervals would result in more representative measurements in the desert shrub ecosystem.

Measurements were taken by placing the board on the ground and "reading" the amount of vegetation covering each interval. Readings

were taken at three distances from the board, 2 m, 4 m, and 8 m at 20 stations, placed 25 m apart along a transect line. Information from such measurements was obtained in hopes of describing more than just canopy cover used by quail, but also understory and overhead cover preference. A complete summary of the vegetation data is presented in Appendix A.

Results and Discussion

Table 37 shows the observations of scaled quail within the study area from November 1980 to August 1981, grouped according to the four seasonal sample periods. The locations of observations are shown on Figure 15. Yearly totals for each major plant community in which quail were observed are summarized in Table 38. Quail were observed in mixed shrub and greasewood in all four seasonal sample periods and sagebrush in all but winter. The largest number of individual quail were observed in the greasewood community in the fall (29%), winter (56%), and spring (57%) sample periods and overall (33%). The greasewood community also had the highest overall number of groups (31%) of quail observed of any major vegetation type in which quail were seen.

The grassland vegetation community showed the second highest percentage of observations (40%) in fall, and the highest (40%) in summer with no observations in winter and spring. These observations are not considered significant since the grassland types in the study area are generally located in narrow swales between the vegetation types which offer suitable cover. It is assumed that the birds were "passing

Table 37. Observations of scaled quail for each seasonal sample period, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Sample Season	Date	Major plant community	No. of groups	Ave. group size	Range	Total nos.	% of total observations
Fall	Nov. 80	Mixed Shrub	3	13.0	8-20	39	17
		Sagebrush	7	6.0	1-11	40	17
		Greasewood	6	11.0	4-25	67	29
		Grassland	3	20.0	8-40	61	26
		Badlands	2	-	3-24	27	12
	Total		22	10.9	1-40	234	
Winter	Jan. 81	Mixed Shrub	2	-	15-16	31	43
		Greasewood	3	14.0	9-16	41	56
	Total		4	13.0	9-16	72	
Spring	April-May 81	Mixed Shrub	1	1.0	-	1	7
		Sagebrush	1	1.0	-	1	7
		Greasewood	4	2.0	1-3	8	57
		Snakeweed-Galleta	1	2.0	-	2	14
		*Dry lakebed	1	2.0	-	2	14
	Total		8	1.75	1-3	14	

Table 37. Continued

Sample Season	Date	Major plant community	No. of groups	Ave. group size	Range	Total nos.	% of total observations
Summer	June, July, Aug.	Mixed Shrub	7	1.3	1-2	9	19
		Sagebrush	4	2.3	1-4	9	19
		Greasewood	3	2.3	1-5	7	15
		Grassland	2	-	7-12	19	40
		4-wing Saltbush	1	-	-	2	4
		Badlands	1	-	-	2	4
	Total		18	2.7	1-12	48	

*Adjacent greasewood-rabbitbrush dunes.

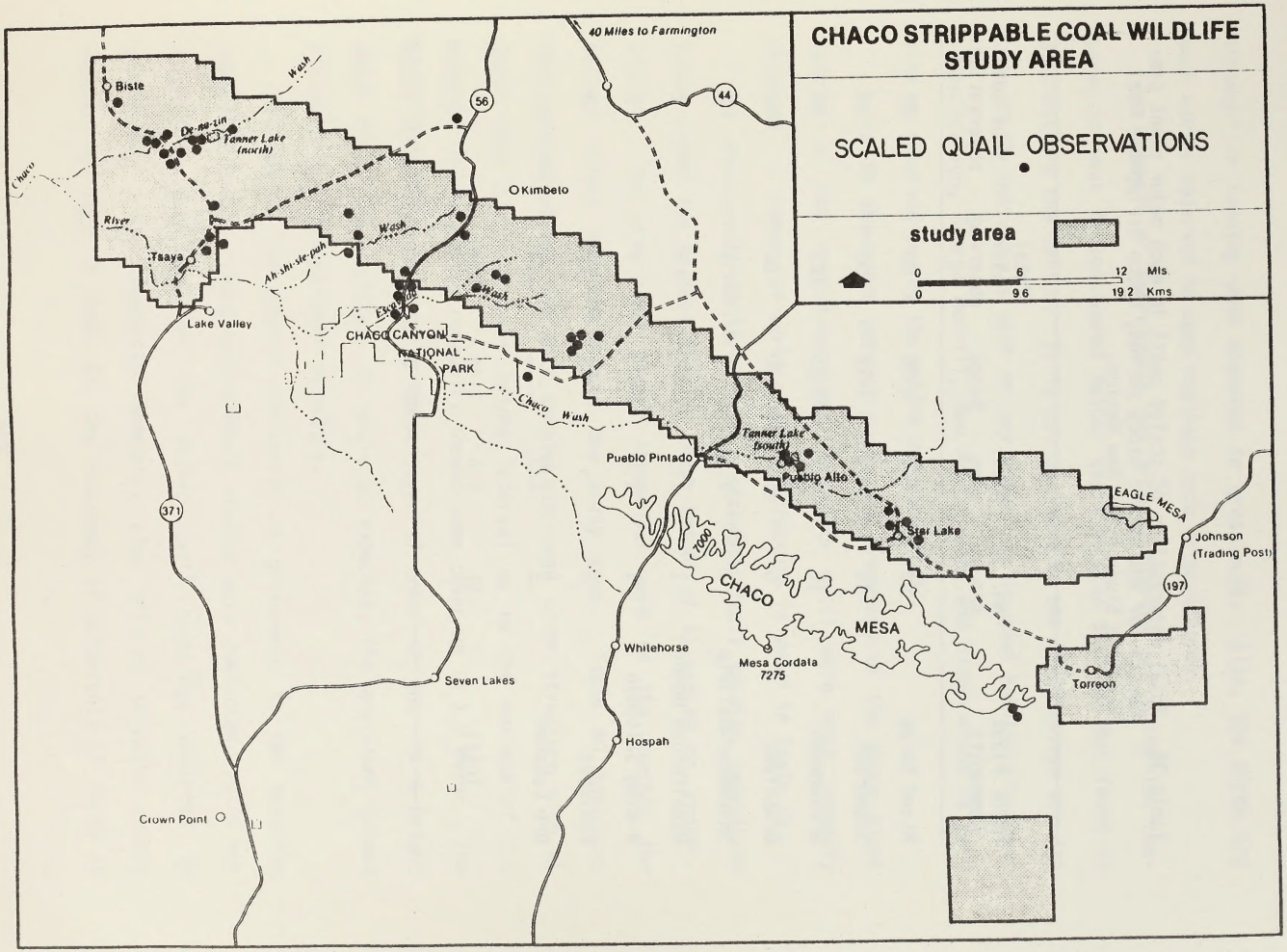
CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
SCALED QUAIL OBSERVATIONS
study area
0 6 12 Mls.
0 9.6 19.2 Kms.
40 Miles to Farmington
Biste
Tanner Lake (north)
Kimbeto
Tsaya
Lake Valley
CHACO CANYON NATIONAL PARK
Chaco Wash
Pueblo Pintado
Tanner Lake (south)
Pueblo Alto
Star Lake
EAGLE MESA
Johnson (Trading Post)
CHACO MESA
Mesa Cordata 7275
Whitehorse
Seven Lakes
Hospah
Crown Point
Torreon
56
44
371
197

Figure 15

Table 38. Total observations of scaled quail in each major plant community for the entire study period, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Major Plant Community	No. of groups	Ave. size	Range	Total nos. observed	% of total observations
Mixed Shrub	13	6.2	1-20	80	22
Sagebrush	12	4.2	1-11	50	14
Greasewood	16	7.7	1-25	123	33
Grassland	5	16.0	7-40	80	22
Snakeweed-Galleta	1	2.0	-	2	1
Rabbitbrush Dunes	1	1.0	-	1	1
4-wing Saltbush	1	2.0	-	2	1
Badlands	2	-	2-24	29	8
Dry Lakebed	1	2.0	-	2	1
Total	51	6.8	1-40	369	

through" or feeding when observed in grasslands. Also, the birds are much easier observed in open habitats such as grasslands.

The numbers of individuals and groups observed are quite low compared to what is considered better quail habitat such as that found in southeastern New Mexico. It is not uncommon to see 15-20 coveys per day with 25-50 individuals each on any given day in good habitat (Personal communication, George Merrill, New Mexico Game and Fish) which is more than we observed during the entire yearlong study.

Table 39 shows the percent cover and frequency of the major plant species of the vegetation types in which quail were most commonly observed. A summary of vertical cover structure is shown in Table 39.

The greasewood/rabbitbrush and greasewood/alkali sacaton vegetation types showed the highest average shrub height of 41 and 66 cm, respectively. The greasewood plants themselves were on the average the tallest shrubs measured within the study area. Table 40 indicates that greasewood had the most complex overhead cover structure with at least some cover in every height interval up to the maximum of 2.5 meters. The sagebrush community showed some cover up to 1.0 meter. The mixed shrub community had a dense layer of cover at the .25 m height which diminished rapidly. As would be expected, the grassland showed virtually no overhead cover structure.

Considering the overall similarity of greasewood to the mesquite community in which many scaled quail studies were conducted, it is not surprising that most of the scaled quail sightings occurred in greasewood. The sagebrush community also offered suitable cover; however, as seen in Table 39, the frequency of occurrence of forbs is

Table 39. Summary of vegetation information collected within areas occupied by scaled quail, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Type	Species	Frequency of occurrence (%)	Cover (%)	Ave. height (cm)
Greasewood/rabbitbrush	Greasewood	14	7	72
	Rabbitbrush	5	5	46
	Russian Thistle	34	5	12
	Alkali Sacaton	16	5	35
	Grasses	47	5	27
	Forbs	62	5	12
	Shrubs	47	14	41
Greasewood/Alkali Sacaton	Greasewood	46	16	94
	Alkali Sacaton	44	8	17
	Russian Thistle	44	5	7
	Grasses	82	11.5	14
	Forbs	55	5	6
	Shrubs	60	18	66
Mixed Shrub	Rabbitbrush	27	5	24
	Snakeweed	48	5	19
	Galleta	48	5	19
	Russian Thistle	38	5	10
	Grasses	83	10	21
	Forbs	73	7	11
	Shrubs	68	11	22

Table 39. Continued

Type	Species	Frequency of occurrence (%)	Cover (%)	Ave. height (cm)
Sagebrush	Big Sagebrush	71	15	38
	Galleta	79	5	17
	Blue Grama	56	5	6
	Grasses	93	10	12
	Forbs	28	5	8
	Shrubs	63	14	34
Grassland	Alkali Sacaton	39	8	27
	Russian Thistle	44	5	5
	Annual Atriplex	20	5	5
	Grasses	78	11	21
	Forbs	56	5	10
	Shrubs	37	5	13

Table 40. Summary of vertical cover structure measurements in areas occupied by scaled quail, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Height (m)	Greasewood	Greasewood/ Rabbitbrush Dunes	Sagebrush	Mixed Shrub	Alkali Sacaton
0.25	35.6[1]	42.5	33.8	59.6	15.3
0.5	25.5	24.1	19.9	10.1	Tr
0.75	20.8	14.7	7.7	Tr	Tr
1.0	9.6	7.1	Tr		
1.25	7.9	3.5			
1.5	5.3	Tr			
1.75	4.6	Tr			
2.0	Tr	Tr			
2.25		Tr			
2.5		Tr			

[1]Represents amount (in percent) of profile board covered by vegetation at various intervals.

much less than the other communities, possibly indicating a lack of food plants. It is assumed that the quail's main use of communities which did not appear to provide adequate cover was primarily for feeding.

There were several species of plants occurring on the study area which have been shown to be important in the diet of scaled quail. Table 41 lists species from several studies that were found on the study area.

Table 41. Some important food plants for scaled quail identified in literature and also found on the Chaco Strippable Coal Wildlife Study Area, New Mexico.

		Banks (1970)	Davis et al. (1975)	Schemnitz (1961)	Russell (1932)	Wallmo (1956)	Sawyer (1973)
Croton	Croton sp.	X	X	X	X		X
Snakeweed	Xanthocephalum sarothrae	X	X				
Russian thistle	Salsola kali	X		X	X		
Sunflowers	Helianthus sp.	X		X	X		X

There are, without doubt, many other plants on the study area that are eaten by scaled quail that do not occur elsewhere within its distribution. Pigweed (Amaranthus spp.) was a preferred food item in several

studies (Banks 1970, Russell 1932, and Schemnitz 1961) although it made up a small percentage of the vegetation. It is interesting that pigweed was not found on the Chaco Coal study area but is distributed throughout New Mexico (Dept. of Agriculture 1971). A valuable addition to the knowledge of scaled quail would be a food habits analysis in northwestern New Mexico.

Water would not be considered a limiting factor in the study area whether or not quail require a constant supply. Watering facilities for livestock have resulted in both an adequate supply and distribution of water throughout the study area.

Summary

Several studies in New Mexico have shown that scaled quail prefer shrub communities with good overhead cover and relatively open ground beneath. Most of the quail observed on the Chaco Coal study area were found in similar situations with greasewood offering the best overall cover structure.

Several plant species important to the diet of scaled quail as indicated in the literature were found in the study area. It is assumed that many other species are consumed but no food habits studies have been conducted in northwestern New Mexico.

Water is not considered a limiting factor because of adequate supply and distribution.

Northwestern New Mexico is considered marginal for scaled quail because of severe winter weather conditions (Russell 1932). Winter

temperatures are at the extreme limit of scaled quail tolerance of cold, therefore, an increase in existing populations is very unlikely. In addition, we can assume that all available habitat is presently occupied by quail (Personal communication, George Merrill, New Mexico Game and Fish) and that transplanting is really not a valid consideration, especially from a cost-benefit standpoint.

Coal mining, of course, will result in a major impact to scaled quail. The most cost effective mitigation would be the avoidance and protection from disturbance of greasewood drainages and greasewood-rabbitbrush dunes including a substantial buffer of vegetation cover. Very important in the mining plan is a suitable reclamation program designed to duplicate as close as possible, the habitat conditions preferred by scaled quail as described in this report and other pertinent literature.

TASK 7 - PRONGHORN HABITAT EVALUATION

Literature Review

Information concerning pronghorn (*Antilocapra americana*) ecology is extensive, but like the scaled quail, none is specific to northwestern New Mexico. Russell (1964) gives records of pronghorn transplants in that part of the state but discusses nothing of the ecology. About 80 pronghorn were transplanted in the extreme northeastern corner of McKinley County between 1937 and 1955. It is assumed that the pronghorn in the Chaco Coal Study Area are remnants of those original transplants.

A large majority of the studies involving pronghorn habitat interrelationships have been summarized by the Bureau of Land Management (1970); therefore, a discussion of those studies will not be presented here. References to pertinent literature are made in the appropriate sections.

Methods

Pronghorn numbers and distribution were determined through aerial surveys and ground observations. All field personnel were instructed to keep accurate records of all sightings throughout the duration of the study. Aerial surveys were completed once each seasonal sample period (see Mammal section of Animal Occurrence Survey for Methods).

Vegetation data collection was conducted simultaneously with scaled quail studies, therefore, the procedure used are described in the methods section of the Scaled Quail Habitat Evaluation and will not be repeated here. A summary of the vegetation data is presented in Appendix A.

Results and Discussion

Table 42 lists the pronghorn observations for both ground and aerial surveys and Figure 16 shows the general distribution within the study area. As can be seen, the same 2 small groups, with 2 and 9 individuals, were observed repeatedly in almost exactly the same locations. Although these locations were intensely surveyed by air, pronghorn were observed only in the fall and spring samples from the aircraft. Ground observations, however, occurred during every sample period for the group of 9 near Star Lake Pump Station. The two individuals observed near Black Lake by Ah-shi-sle-pah Wash were seen only twice during the entire study from the ground and never observed during the aerial survey. On 7/23/81, two fawns were seen with the group of nine near the Star Lake Pump Station indicating that some reproduction is occurring.

Yoakum (1978) has performed exhaustive reviews of the tremendous amount of information concerning pronghorn and compiled what could be termed ideal habitat characteristics on preferred sagebrush-grassland ranges. Table 43 shows a comparison of these "ideal" characteristics with the conditions found on the study area. Table 44 lists some of

Table 42. Pronghorn observations, Chaco Strippable Coal Wildlife Study Area, New Mexico.

Sample Period	Date	Location	Number	Aerial	Ground
Fall	11/7/80	T20N, R6W, S. 22	9		X
	11/9-11/10/80	T20N, R6W, S. 23	9	X	
	11/11/80	T22N, R11W, S. 9	2		X
	11/13/80	T20N, R6W, S. 27	8		X
Winter	1/19/81	T20N, R6W, S. 27	9		X
Spring	5/3/81	T20N, R6W, S. 23	4		X
	5/3/81	T20N, R6W, S. 35	1		X
	5/11-5/12/81	T20N, R6W, S. 27	9	X	
Summer	6/9/81	T22N, R11W, S. 9	2		X
	7/23/81	T20N, R6W, S. 28	11		X

Table 43. Comparison of ideal pronghorn habitat conditions, as described in literature, with conditions in the Chaco Strippable Coal Wildlife Study Area, New Mexico.

	Literature (Yoakum 1978)	Study Area
Vegetation Composition	40-60% grass	39% grass
	10-30% forbs	37% forbs
	5-20% browse	24% browse
Vegetation Height (average)	38 cm	19.7 cm overall
		31.5 for shrubs
Species Composition	5-10 grasses	16 grasses
	20-40 forbs	33 forbs
	5-10 shrubs	15 shrubs
Ground Cover	50% barren	75 barren
	50% vegetation	25 vegetation
Sagebrush Density	10-24%	14%

Table 44. Important food plants found on the Chaco Strippable Coal Wildlife Study Area, New Mexico.

Artemisia tridentata	Big sagebrush
Artemisia filifolia	Sand sagebrush
Atriplex canescens	4-wing saltbush
Atriplex confertifolia	Shadscale
Chrysothamnus viscidiflorus	Green rabbitbrush
Xanthocephalum sarothrae	Snakeweed
Opuntia sp.	Prickly pear cactus
Aster sp.	Aster
Astragalus sp.	Milkvetch
Eriogonum sp.	Buckwheat
Euphorbia sp.	Spurge

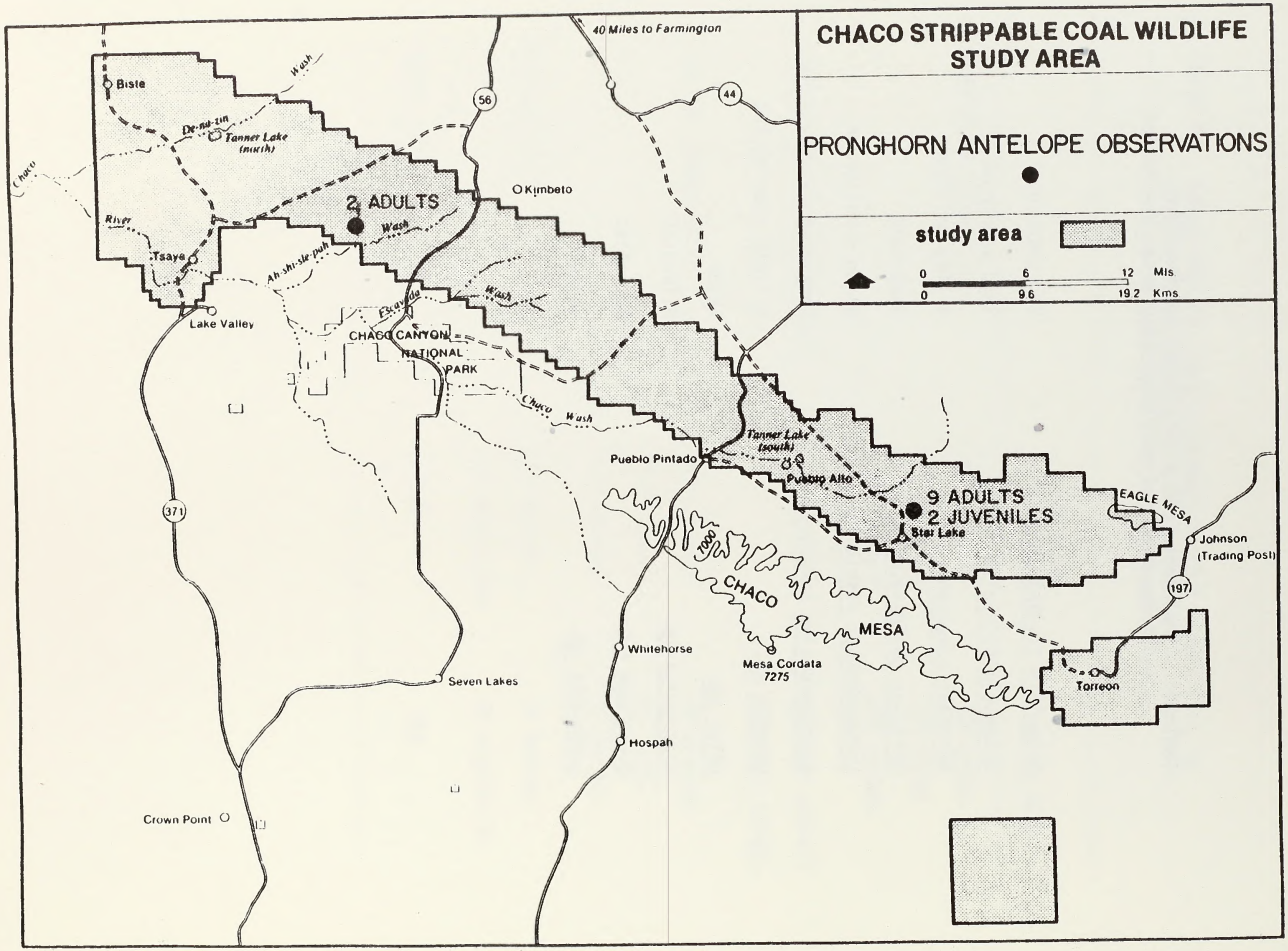
CHACO STRIPPABLE COAL WILDLIFE STUDY AREA
PRONGHORN ANTELOPE OBSERVATIONS
study area
0 6 12 Mls
0 9.6 19.2 Kms
40 Miles to Farmington
Biste
Tanner Lake (north)
2 ADULTS
Kimbeto
Tsaye
Lake Valley
CHACO CANYON NATIONAL PARK
Pueblo Pintado
Tanner Lake (south)
Pueblo Alto
9 ADULTS
2 JUVENILES
Star Lake
EAGLE MESA
Johnson (Trading Post)
CHACO MESA
Mesa Cordata 7275
Torreon
Whitehorse
Seven Lakes
Hospah
Crown Point
56
44
371
197

Figure 16

the plant species found on the study area that have been shown to be important in the diet of pronghorn (Bureau of Land Management 1970). There are undoubtedly numerous other species consumed within the study area that have not been documented in the literature.

The "vegetation profile" or vertical cover structure measurements, although conducted on pronghorn range, are not meaningful since pronghorn do not key on canopy cover or understory vegetation. Such information may be useful for associating newborn fawn behavior with understory vegetation; however, few, if any, conclusions could be drawn from the small population that exists on the study area.

Assuming the pronghorn in the study area exhibit similar characteristics as pronghorn of other regions, it appears that habitat conditions, as indicated by the data, are fairly close to what are preferred according to Yoakum (1978). The distribution of water sources appears to be adequate; however, many of them retain water only during a few months and not consistently every year. A thorough inventory of permanent water has not been completed for the study area.

It appears that severe competition from sheep grazing is a primary limiting factor. Although a good mixture of preferred forage is present, as indicated by the data, it is probably not available since heavy sheep grazing is carried out yearlong.

Another important limiting factor is the lack of availability of water on a permanent year after year basis. Because of alternating wet and dry periods, water may be available in some years but not others.

Other highly significant mortality factors are predation by a high population of both coyotes and domestic dogs and poaching. Considering

these factors, expansion of the herd is doubtful and eventual extinction of this population is likely. Because of these problems, the scattered land pattern, and the attitudes of the local residents toward the land, make any future management of the pronghorn in this area highly doubtful (Mannen Clements, New Mexico Game and Fish Department, Personal communication).

For these reasons, we felt that identification of areas suitable for transplants would not be a cost-effective exercise. The few pronghorn that exist there now would obviously be displaced by mining; however, because the adjacent areas are not currently occupied, the habitat could easily support these few animals. In addition, since management by New Mexico Game and Fish Department is a low priority, any money spent on transplanting would far outweigh the benefits derived.

Perhaps once mining is completed and if proper rehabilitation is accomplished, some of the problems relating to pronghorn survival may be eliminated and a viable population can be established.

SUMMARY DESCRIPTIONS

Introduction

The following paragraphs are descriptions of each standard habitat site and special habitat feature within which data were collected. We attempted to present the most noteworthy information for each site. No quantitative information is presented for the vegetation but the interested reader is referred to Appendix A and the descriptions of the standard habitat sites for this data.

Standard Habitat Sites and Special Habitat Features

Badlands

The badlands are characterized by steep clay hills and deep and often narrow washes. The only vegetation occurs in the bottom of these washes. The primary species are buckwheat (*Eriogonum sp.*), greasewood (*Sarcobatus vermiculatus*), Russian thistle (*Salsola kali*), and three species of saltbush, (*Atriplex obovata*, *A. saccaria*, and *A. confertifolia*). Wildlife use is relatively light. A total of 7 mammal species, 16 bird species, and 4 reptile species were identified using the badlands. The deer mouse (which was abundant), horned lark, and desert side-blotched lizard were the most common. Diversity indices are .48, .97, and 1.64 for mammals, birds, and herpetofauna, respectively.

The importance of the badlands for wildlife should not, however, be underestimated. All of the nests of the Say's phoebe and 3 out of 4

ferruginous hawk nests were found in the badlands. It is interesting that the badlands was one of the two SHS's in which the porcupine was observed consistently.

Ricegrass/Snakeweed Dunes

The ricegrass/snakeweed dunes have a low diversity from both a vegetation and wildlife standpoint. It has a low structural complexity of vegetation. This SHS is most commonly associated with stabilized sand dunes and is found only in the northwestern part of the study area. It had the least number of bird species with 14. There were 13 species of mammals and 4 species of reptiles identified. Of the 13 species of mammals, only 5 were considered common and none were abundant. The reptiles, on the other hand, were quite abundant with 138 speckled earless lizards, 94 northern sagebrush lizards, and 34 little striped whiptails. The only nests located were one horned lark and one black-throated sparrow. Diversity indices are 1.28, .52, and 1.47 for mammals, birds, and herpetofauna, respectively.

Alkali Sacaton/Annual Atriplex Swale

The alkali sacaton/annual atriplex swale is the closest to a pure grassland type of any other SHS. It has a very low structural complexity of vegetation as evidenced by the low diversity of mammals, birds, and herpetofauna. Out of 19 species of birds only 4 were considered common and only one, the horned lark, was abundant. Several observations of the mountain plover were made in this SHS. The northern

harrier used this type quite extensively. The most common mammal was the deer mouse and the speckled earless lizard was the most common reptile species. Diversity indices are .92, .20, .80 for mammals, birds, and herpetofauna, respectively.

Snakeweed/Galleta Uplands

This is another SHS with a relatively low overall diversity. It is found on the tops of rolling hills or on stabilized sand dunes. The horned lark, which prefers open habitat, was abundant but only 2 of the remaining 23 species of birds were considered common. The only nest found was that of the black-throated sparrow. The most common of the 16 species of mammals were the silky and plains pocket mice. Only 3 species of herpetofauna were identified with northern sagebrush lizard being the most common. Diversity indices are .85, .53, and 1.09 for mammals, birds, and herpetofauna, respectively.

Mixed Shrub Rolling Uplands

This SHS has a high diversity of plant species but a relatively low structural complexity relating to cover. It is not dominated by any plant species in either composition or canopy cover and has the appearance of a grassland. It is most often associated with rolling hills and sandy soil. It appears to be intermediate in its relative importance to birds and mammals as compared to the other SHS's. It is of relatively high importance, however, to reptiles. There were 7

species of reptiles identified with the northern sagebrush lizard being quite abundant. Of the 17 species of mammals identified, 9 were considered common and one, Ord's kangaroo rat, was abundant. There were a total of 28 species of birds observed with 7 being common and 2, the horned lark and black-throated sparrow, being abundant. Only 2 nests, 1 loggerhead shrike and 1 black-throated sparrow, were located in the mixed shrub. One of the 2 observations of the scissor-tailed flycatcher was made in this SHS. Diversity indices are 1.34, 1.12, and .77 for mammals, birds, and herpetofauna, respectively.

Big Sagebrush/Galleta Rolling Uplands

This was the largest SHS within the study area. It has a relatively high diversity of plant species and a good structural complexity relating to cover. It was not, however, as important to wildlife as expected. Of the 32 species of birds identified, 10 were considered common and the sage sparrow and Brewer's sparrow were abundant. It had the most song bird nests in both number of nests and different species. There were 14 nests of 6 species of birds. Common nesting species included the sage sparrow (6 nests) and Brewer's sparrow (4 nests). The only sighting of a Virginia's warbler was made in this SHS.

There were 15 species of mammals identified, of which 5 were common and one, the deer mouse, was abundant. A total of 5 species of reptiles were observed with the northern sagebrush lizard being the most common. The only sighting of the Mexican hognose snake was made in this SHS.

Diversity indices are .98, 1.38, and .62 for mammals, birds, and herpetofauna, respectively.

Greasewood/Rabbitbrush Dune

This SHS is generally associated with sand dunes adjacent to the major washes of the study area. Although there is considerable bare ground in this community, it has high structural complexity in both the vegetation understory and cover. Because of this structural diversity in the vegetation, it supports a relatively diverse population of wildlife. A total of 38 species of birds were observed in this type. The horned lark was the only bird considered abundant. There were 6 species considered common and 6 species moderately common. This SHS was one of the most important for scaled quail. Three species, the western wood pewee, house wren, and tree sparrow, were observed only in this SHS.

A total of 14 species of mammals were observed with 8 being considered common. The blacktailed jackrabbit was observed more often in this community than any other SHS.

There were only 4 species of reptiles identified with the northern sagebrush lizard being quite common. This SHS would not be considered of major importance to herpetofauna. Diversity indices are 1.48, 2.00, and .75 for mammals, birds, and herpetofauna, respectively.

Greasewood/Alkali Sacaton Drainage

This SHS is often adjacent to the greasewood/rabbitbrush dunes along the major drainages of the study area and in many respects, is similar in appearance and vegetational diversity. It has the highest average shrub height of any SHS and has considerable bare ground. It is among the highest SHS in structural complexity of both understory and canopy cover.

There were 12 species of mammals identified with 4 considered common and 2 species, the deer mouse and western harvest mouse abundant. Both the desert cottontail and the black-tailed jackrabbit were quite common.

This SHS was quite important for avian species judging from the observation of 42 species. Ten species were judged common and 4 abundant including the sage sparrow, Brewer's sparrow, and chipping sparrow. The scaled quail was observed more often in this SHS than any other. The blue grosbeak and lark bunting were seen only in this SHS. This SHS was, however, one of the least used by herpetofauna with only 2 species recorded, the ubiquitous northern sagebrush lizard and common speckled earless lizard. Diversity indices are .90, 2.22, and .34 for mammals, birds, and herpetofauna, respectively.

Pinyon-Juniper Hills

This SHS is considered highly important for all wildlife although it is confined to Chaco Mesa in the southern part of the study area. It is associated with bluffs, mesas, cliffs, and rock outcrops giving it a

high degree of "edge effect" resulting in a highly diverse fauna. A total of 39 bird species, 18 mammal species and 6 species of herpetofauna were identified. This was the only type in which the pinyon jay, white-throated woodrat, and northern tree lizard were found in sufficient numbers to be considered common. The deer mouse and pinyon mouse were found to be abundant. This was one of the two habitats in which the uncommon canyon mouse was captured and the only type where the silver-haired bat was identified. The only nests of the violet-green swallow and rock wren within the study area were found in this type. In addition, the only evidence of mule deer and mountain lion within the study area was observed in this SHS along with one of the two bobcats seen during the survey. Species of birds which were observed only in this SHS were rufous hummingbird, downy woodpecker, and pine siskin. Diversity indices are 1.41, 1.98, 2.11 for mammals, birds, and herpetofauna, respectively.

Pinyon-Juniper/Sagebrush Hills

This SHS is considered the most important community within the study area because of its highly complex vegetational structure resulting in a highly diverse fauna. As with the pinyon-juniper hills, it is often associated with rock outcrops and cliffs. Its importance is compounded by the fact that it is one of the smallest SHS's within the study area.

Of the 18 mammal species found in this type, 9 were considered common and none were abundant. Most of the Colorado chipmunks observed in the study area were seen in this SHS and the only rock squirrel capture

was made here. The few porcupines occupying the study area seemed to prefer the pinyon-juniper/sagebrush adjacent to the badlands. The highest number of bird species were observed within this SHS. Of the 66 species identified, 15 were considered common. The abundant species included mountain bluebird, loggerhead shrike, chipping sparrow, and clay-colored sparrow. The great horned owl was found most often in this SHS. There were 14 species of birds observed in this SHS and seen nowhere else in the study area. These include the poor-will, Lewis' woodpecker, white-breasted nuthatch, American robin, ruby-crowned kinglet, yellow-rumped warbler, MacGillivray's warbler, Wilson's warbler, Scott's oriole, hepatic tanager, rosebreasted and black-headed grosbeaks, goshawk, and merlin. This SHS is, however, somewhat less important for herpetofauna. Only 4 species were observed with the northern sagebrush lizard being quite abundant. Two specimens of the yellow-headed collared lizard were observed along with 15 of the 17 total for the uncommon plateau striped whiptail. Diversity indices are 1.89, 2.41, and 1.03 for mammals, birds, and herpetofauna, respectively.

Special Habitat Features

Cliff/Rock Outcrops

Cliffs and rock outcrops are combined for the purposes of discussion since they nearly always occur together and are similar in ecological characteristics. Cliffs/rock outcrops are considered the most important special habitat features for wildlife within the study area.

The largest number of mammal species (19) were identified in this SHF, although 13 were classified as uncommon. The only abundant species was the deer mouse. Three of the five species of bats found in the study area were captured or observed in rock outcrops and the only captures of Stephens woodrat were made here. One of the two bobcat observations came from this SHF.

A total of 26 avian species were found using cliffs/rock outcrops. The only species considered common were the red-tailed hawk, golden eagle, prairie falcon, and American kestrel. In addition, 33 of the 49 raptor nests (not including 14 common raven nests) recorded were located on cliffs or rock outcrops.

The largest number (9) of reptile and amphibian species found in any habitat type including both SHS's and SHF's were observed in rock outcrops. The largest populations of the desert side-blotched lizard and the northern plateau lizard were found in this SHF. In addition, the desert striped whipsnake was observed here. Diversity indices are 1.89 and 1.87 for mammals and herpetofauna, respectively.

Stock Ponds/Water Tanks/Windmills/Reservoirs/Flowing Wells and Creeks

These several special habitat features were combined because of their similarity in use by wildlife. The importance of these water sources for migrating birds cannot be overemphasized. A total of 29 species of migratory birds were observed using these SHF's. In addition, they are important sources of water for many species of wildlife. Eight species of herpetofauna were observed around water sources. The

wandering garter snake was found exclusively around perennial stock ponds.

The dry lake beds surveyed, such as Tanner Lake (north), showed surprisingly high use by wildlife. It is suspected that the cover provided by the tamarisk as well as its value to perching birds encourage this use by wildlife.

RECOMMENDATIONS FOR MITIGATION

Mammals

1. The majority of the common mammals observed during this survey are not extremely sensitive to indirect disturbance as long as suitable habitat in sufficient quantity is available. Direct perturbations will, of course, impact all species in the vicinity of the disturbance; to what degree depends on the severity of the impact. Therefore, our primary recommendation concerning the maintenance of mammalian species is to localize disturbance to as small a scale as possible. The broader the impact, the more mammal populations (individuals as well as species in terms of numbers and degree) are affected.

2. Disturbance to the pinyon-juniper/sagebrush hills, pinyon-juniper hills, greasewood/alkali sacaton drainages, and greasewood/rabbitbrush dunes should be kept to an absolute minimum. These habitat types were found to be very important to many species of mammals as well as constituting a very small portion of the total study area.

3. Annual programs to monitor area mammals should be established. We suggest the following design.

   a. A live-trapping program to sample rodents should be carried out within each SHS. The same procedures described under METHODS in the MAMMAL SURVEY for small mammal trapping are recommended but with a lower intensity.

b. Predator scent stations should be continued to monitor study area carnivores.

c. We do not recommend mist netting as a primary monitoring program technique. This is frequently a very time-consuming effort, and unless conducted intensively, provides limited returns. We suggest that, should important bat habitat come under heavy impact, a special team carry out a chiropteran survey at the appropriate level of intensity.

d. The current status of the distribution and abundance of existing prairie dogs in the Chaco Strippable Coal area should not be altered. This real/potential ferret habitat could be destroyed, or altered to a point that would preclude ferret use, directly by developmental operations, or indirectly by increased human access. There is normally not a significant impact problem on prairie dog colonies if they are not directly disturbed. However, chronic indirect disruption, such as nearby road traffic, can significantly impact towns through opportunistic, but intense, shooting, i.e., the nearer the road, the more prairie dogs are shot. We recommend, therefore, that all new roads resulting from mining activity be placed as far from prairie dog concentrations as possible.

Birds

This section contains recommendations generally pertaining to all avian species. However, the focus is on nonraptorial, nongame birds.

These species are treated separately, and in depth, further on in this discussion.

1. We recommend that the disturbance of native vegetation be held to a minimum and that it be as localized as possible. It is reasonable to conclude that the destruction or significant alteration of major portions of any of the vegetation/habitat types will undoubtedly decrease species diversity within the area. Once the vegetation within an area has been significantly disturbed, it may be many years before it is suitable for utilization by birds which were present before alteration. Care should be taken to minimize the impact on the pinyon-juniper sagebrush hills, pinyon-juniper hills, greasewood/rabbitbrush dunes, greasewood/alkali sacaton drainages and ponds. They are limited in total area and are utilized by species whose requirements are often sufficiently restrictive that they cannot shift to alternate habitats.

2. We recommend that an annual monitoring program be carried out using one of the alternative procedures outlined below. We suggest that the transects and surveys established during the field program (described in AVIAN SURVEY) be utilized to monitor the status of the avian species over the project area. This monitoring would be done principally to provide information on the nonraptorial sector of the bird population. This program may be carried out at three different levels of intensity.

a. Monitor bird activity during the months of January, March, May, June, August, and October with a program similar to that of the original field study. Comparisons should be made between data

collected each sampling period each year. Such a program would provide intensive monitoring data.

b. Monitor bird activity during the months of January and June with procedures similar to those used during the same months in the original study. Comparisons should be made between bird observations collected on transects and surveys between years. This monitoring program would provide information on the status of species which spent a significant portion of the year within the project area.

c. Monitor breeding bird activity in June. This represents the minimum level of monitoring effort recommended. Although much less intensive than the original baseline study, it would, nonetheless, provide a good indication of the status of the regional birds. Two factors are involved in our recommendation of this program. First, breeding birds are liable to be the most affected by changes in overall habitat quality. Second, because of the rather stationary nature of the breeding birds, indices obtained during the breeding season are more likely to be representative of the actual densities of birds in an area than are indices collected during other periods when the birds are more transient. Thus, as a minimum monitoring effort for nonraptorial birds, we recommend the following procedure.

1) Avian transects within pinyon-juniper/sagebrush, pinyon-juniper hills, greasewood/rabbitbrush dunes, and greasewood/alkali sacaton drainages should be run each spring,

preferably late May and early June. A comparison, between years, of abundance indices for selected species, as well as species composition for each survey should be performed to evaluate the status of the birdlife in the given year for the area covered by each survey.

Two points are significant enough to be reemphasized. First, only the abundance of the more common and conspicuous species (see Table 25) should be compared on an annual basis to determine the impact of land (habitat) alteration. Abundance indices calculated for the less numerous or uncommon species reflect chance to a large degree and are not always indicative of actual abundance, i.e., a large proportion of species recorded in the area occur in very low densities, and observing them is more by chance than design.

Second, species richness and composition are useful in determining the impact of habitat alteration. While the bulk of the individuals in the area are comprised of only a few species (the actual species depends on the season), the total number of species and their composition are useful indicators of the status of various habitat types. A major change in species richness or a shift in composition will indicate an alteration of the habitat. Thus, while abundance indices for certain species may not be utilitarian, the actual occurrence and numbers of the species within the area is meaningful.

Raptors

The recommendations outlined below are two-fold. First, we suggest management alternatives directed at avoiding situations detrimental to the raptor populations. Second, we present a monitoring program which will yield data of sufficient quality and depth for comparability over the years, thus providing a means of detecting trends in the raptor population.

1. The following management recommendations are made with the understanding that all wildlife populations must have, in order to survive, adequate food, shelter, and breeding habitat. If any of these is lacking or reduced, resident wildlife populations will suffer. To insure the integrity of the study area raptor population, an adequate prey base, roosting cover, and nesting habitat must be sustained. Winter food and roosting cover must be maintained to also insure that the area continues to support migrating and wintering raptors. Any lessening of these resources will directly and adversely affect the nesting, wintering, and migratory raptor population.

2. Because roosting sites (trees etc.) are already limited, the installation of new power lines will very likely attract roosting raptors. Nelson (1978) and Nelson and Nelson (1976) outline the potential mortality associated with certain types of power lines (distribution lines of less than 69,000 volts) when used by raptors, and describe ways in which these lines can be modified to reduce raptor electrocutions (Transmission lines, or those over 69,000 volts, are currently constructed in such a way as to present no major hazard to raptors.)

These construction recommendations should be followed when new power lines are brought into the study area.

3. The most critical period for the nesting raptor population is during the mid-March to mid-July reproductive season. Any serious disturbance, primarily human presence, during the early incubation stages (mid-March to mid-May) can lead to nest abandonment. As the nesting season progresses, the chances of nest abandonment continue to decrease, until late July when the last young have fledged. The study area raptor population is, in all probability, the most tolerant of human activity from early August to the beginning of the winter season.

4. If on-site activities are conducted in such a way as to consider the needs of the raptor populations, particularly those considered "sensitive," then a major step will have been taken to insure the survival of these wildlife species. An additional problem, and one potentially greater than the actual presence of resource development in the region, will be the increased public use of the land.

5. Since particular portions of the habitat will certainly be altered or disturbed, every effort must be taken to insure that these perturbations are as localized as possible, and that habitat which does remain is maintained in the best possible condition for the native wildlife.

6. We recommend an annual monitoring program that includes both aerial censuses and ground observations. Aerial surveys should be conducted between mid- and late April, and should emphasize known nest sites and potential nesting areas (wooded drainages and rimrock). This will provide data on early nesting activities. An optional, but

recommended flight should occur between mid- and late May and should again emphasize nesting areas.

The nesting season aerial surveys should be followed immediately by four or five days of extensive ground observations, e.g., walking all of the rimrock areas and major washes, searching for new nests and confirming the findings of the aerial survey.

Four to six days of ground observations should be made in late June or early July to determine nest success and productivity.

Amphibians and Reptiles

1. The primary recommendation for the herpetofauna of the study area is a monitoring program. Since formal surveys are quite time-consuming, we suggest that the complete records of the herpetofauna sightings be maintained. Personnel involved in the bird and mammal surveys should record all sightings on transects and roads.

2. We would like to emphasize the importance of maintaining, at least, incidental records of reptiles and amphibians on the project area. These groups normally exhibit population stability and are, therefore, excellent indicators of significant disturbance, or long-term impacts. The size of the study area, and the potential habitat restrictions and low level of observability of most "herps," makes them very difficult to systematically locate in any numbers; thus the relevance of incidental sightings.

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APPENDIX A

Vegetation Information

Table 1. Plant species present on Chaco Strippable Coal Wildlife Study Area, New Mexico.

Common Name	Scientific Name
Bottlebrush Squirreltail	*Sitanion hystrix*
Feathergrass	*Stipa neomexicana*
Needle-and-Thread	*S. comata*
Purple Three-awn	*Aristida purpurea*
Red Three-awn	*Aristida longiseta*
Galleta	*Hilaria jamesii*
Ring Muhly	*Muhlenbergia torreyi*
Muhly Grass	*M. thurberi*
Spike Muhly	*M. wrightii*
Sand Dropseed	*Sporobolus cryptandrus*
Alkali Sacaton	*S. airoides*
Spike Dropseed	*S. contractus*
Giant Dropseed	*S. giganteus*
Cheatgrass	*Bromus tectorum*
Six-week Fescue	*Vulpia octoflora*
Indian Ricegrass	*Oryzopsis hymenoides*
Little Barley	*Hordeum pusillum*
Fluffgrass	*Erioneuron pulchellum*
Blue Grama	*Bouteloua gracilis*
Western Wheatgrass	*Agropyron smithii*
Wild Lettuce	*Lactuca sp.*
Aster	*Aster sp.*
Buckwheat	*Eriogonum sp.*
Curly Dock	*Rumex crispus*
Phlox	*Phlox sp.*
Indian Paintbrush	*Castilleja sp.*
Penstemon	*Penstemon angustifolius*
Horsemint Beebalm	*Monarda menthaefolia*
Plantain	*Plantago purshii*
Scorpion Weed	*Phacelia corrugata*
Blazing Star	*Mentzelia multiflora*
Globemallow	*Sphaeralcea parvifolia*
Pale Evening Primrose	*Oenothera pallida*
Evening Primrose	*Oenothera albicaulis*
Yellow Crownsbeard	*Verbesena enceloides*
Sand Verbena	*Abronia sp.*
Russian Thistle	*Salsola kali*
Burro-weed	*Aplopappas tenuisectus*
Spurge, Croton	*Euphorbia fendleri*
Locoweed	*Astragalus sp.*
Wild Onion	*Allium sp.*
Borage	Fam. Boraginaceae
Scurfpea	*Psoralea lanceolata*
Catseye	*Cryptantha crassisepala*
Stickseed	*Lappula sp.*
Ephedra	*Ephedra torreyana*
Jim Hill Mustard	*Sisymbrium altissimum*

Table 1. Continued

Common Name	Scientific Name
Mustard	Fam. Cruciferae
Spectaclepod	*Dithyrea wislenzii*
Cholla	*Opuntia sp.*
Prinkly Pear	*Opuntia sp.*
Big Sagebrush	*Artemisia tridentata*
Bud Sagebrush	*Artemisia spinescens*
Black Sagebrush	*Artemisia nova*
Old Man Sagebrush	*Artemisia filifolia*
Rubber Rabbitbrush, Gray Rabbitbrush	*Chrysothamnus nauseosus*
Green Rabbitbrush, Douglas Rabbitbrush	*Chrysothamnus viscidiflorus*
Saltbush, annual	*Atriplex saccaria*
Saltbush	*Atriplex obovata*
Four-wing Saltbush	*Atriplex canascens*
Shadscale	*Atriplex confertifolia*
Winterfat	*Ceratoides lanata*
Seepweed	*Suaeda torreyana*
Greasewood	*Sarcobatus vermiculatus*
Broom Snakeweed	*Xanthocephalum sarothrae*
Squawbush, Skunkbush	*Rhus trilobata*
Serviceberry	*Amelanchier sp.*
Mountain Mahogany	*Cercocarpus montanus*
Cliffrose	*Cowania mexicana*
Antelope Bitterbrush	*Purshia tridentata*
Pale Wolfberry	*Lycium pallidum*
Gambel's Oak	*Quercus gambellii*
Juniper	*Juniperus sp.*
Pinyon Pine	*Pinus edulis*
Yucca, Soapweed	*Yucca sp.*

Table 2. Percent cover and average height of grasses, forbs, and shrubs in each SHS.

Habitat Types	Grasses							Forbs							Shrubs						
		% Cover			Height (cm)				% Cover			Height (cm)				% Cover			Height (cm)		
	Freq.	Mean	S.D.	Variance	Mean	S.D.	Variance	Freq.	Mean	S.D.	Variance	Mean	S.D.	Variance	Freq.	Mean	S.D.	Variance	Mean	S.D.	Variance
Greasewood-Rabbitbrush Dunes	48%	4.73	10.8	117.0	27.0	21.0	442.3	62%	5.28	11.5	132.2	11.67	7.77	60.14	48%	14.5	26.3	687.0	41.4	37.0	1367.0
Greasewood-Alkali Sacaton Drainage	82%	11.5	15.6	243.0	14.2	10.4	107.6	55%	2.0	3.5	12.0	5.5	4.6	21.0	60%	18.0	30.0	874.0	66.0	83.0	6792.0
Big Sagebrush-Galleta Rolling Uplands	93%	10.4	9.0	80.0	12.2	8.9	80.0	28%	0.90	2.2	4.8	7.7	4.7	22.0	63%	14.4	25.5	651.0	34.2	23.0	514.6
Mixed Shrub Rolling Upland	83%	10.3	13.2	172.4	21.4	14.2	202.0	73%	7.1	12.0	135.2	12.0	8.8	78.0	68%	11.0	19.4	373.0	22.0	13.0	160.2
Snakeweed-Galleta Uplands	91%	9.6	12.0	138.0	17.4	9.3	87.0	72%	4.0	13.0	162.3	8.0	5.3	28.0	73%	5.0	5.5	31.0	18.0	7.3	53.4
Ricegrass-Snakeweed Dunes	92%	14.0	14.0	190.0	23.0	14.4	206.2	47%	1.2	1.6	2.6	6.4	5.0	24.6	70%	6.3	13.4	177.3	21.0	12.6	155.0
Alkali Sacaton-Annual Atriplex Swale	78%	12.0	18.0	304.6	21.0	11.2	124.0	56%	3.0	4.4	20.0	10.0	7.0	48.0	37%	1.6	3.6	13.0	13.6	9.5	90.0
Pinyon-Juniper Sagebrush Hills	82%	6.3	8.0	64.0	11.0	8.0	65.0	23%	2.0	12.6	157.0	7.0	6.3	39.4	80%	31.0	30.0	882.0	42.0	28.0	766.0
Pinyon-Juniper Hills	71%	7.4	11.0	118.0	16.4	8.7	74.6	25%	1.0	3.3	11.0	7.4	6.4	40.0	75%	7.0	12.0	143.0	26.3	23.0	520.0
Badlands	.78%	0.07	0.88	0.76	20.0	-	-	2.3%	0.17	1.4	1.9	18.3	10.4	72.2	16%	0.96	3.3	11.0	11.4	7.5	54.2

Table 3. Percent cover and average height of the dominant plants in each SHS.

Habitat Types	Dominant Plant Species	Frequency	% Cover			Height (cm)		
			Mean	S.D.	Variance	Mean	S.D.	Variance
Greasewood-Rabbitbrush Dunes	Salsola kali	34.0%	2.7	12.0	142.0	11.7	7.4	54.0
	Sporobolus airoides	16.0%	2.96	11.0	116.6	34.6	28.7	798.0
	Sarcobatus vermiculatus	14.2%	6.77	21.3	451.0	72.0	42.0	1682.0
	Atriplex obovata	11.1%	1.3	6.1	37.0	11.4	6.1	34.5
	Hilaria jamesii	4.9%	0.98	7.4	54.4	16.2	6.4	36.0
	Chrysothamnus	1.35%	3.6	14.3	204.6	46.4	26.0	646.0
Greasewood-Alkali Sacaton Drainage	Sarcobatus vermiculatus	46.0%	16.1	29.0	832.0	94.5	93.0	8507.0
	Sporobolus airoides	44.0%	8.1	15.4	238.3	17.3	13.0	169.0
	Salsola kali	44.0%	TR	-	-	-	-	-
	Sphaeralcea parvifolia	23.0%	TR	-	-	-	-	-
Big Sagebrush-Galleta Rolling Uplands	Artemisia tridentata	71.0%	14.7	21.2	450.0	38.2	23.0	525.0
	Hilaria jamesii	79.0%	3.23	4.84	34.0	17.0	7.6	57.4
	Bouteloua gracilis	55.6%	4.9	6.53	42.4	5.65	2.0	4.5
Mixed Shrub Rolling Upland	Hilaria jamesii	48.0%	4.4	14.0	189.4	18.7	10.4	107.6
	Xanthocephalum sarothrae	48.0%	3.5	6.0	35.0	19.0	7.0	49.0
	Salsola kali	38.0%	3.1	10.0	99.0	10.1	9.0	79.2
	Chrysothamnus	27.0%	4.4	12.0	142.0	23.6	10.0	97.1
Snakeweed-Galleta Uplands	Hilaria jamesii	79.0%	6.6	8.4	70.3	21.0	9.6	91.0
	Xanthocephalum sarothrae	68.0%	3.8	4.5	20.0	18.3	5.6	31.0
	Salsola kali	53.0%	TR	-	-	-	-	-
Ricegrass-Snakeweed Dunes	Oryzopsis hymenoides	72.0%	5.5	7.3	52.6	29.0	11.5	132.0
	Xanthocephalum sarothrae	49.0%	2.65	3.9	15.0	18.6	10.0	98.6
	Vulpia octoflora	14.0%	0.316	0.88	0.77	12.7	3.4	10.7
	Chrysothamnus	14.0%	2.2	10.0	97.0	21.0	11.0	113.0
Alkali Sacaton Annual Atriplex Swale	Salsola kali	44.0%	TR	-	-	-	-	-
	Sporobolus airoides	39.0%	7.6	17.0	285.0	27.4	10.5	109.0
	Atriplex saccaria	20.0%	TR	-	-	-	-	-
Pinyon-Juniper Sagebrush Hills	Artemesia tridentata	58.0%	19.6	29.0	835.0	53.0	26.4	692.0
	Bouteloua gracilis	50.0%	7.2	8.3	68.5	6.5	5.5	30.1
	Hilaria jamesii	32.0%	TR	-	-	-	-	-
	Vulpia octoflora	26.0%	TR	-	-	-	-	-
	Xanthocephalum sarothrae	23.0%	4.4	14.0	188.3	16.0	7.1	48.4
	Juniperus	7.0%	TR	-	-	-	-	-
Pinyon-Juniper Hills	Hilaria jamesii	54.0%	3.3	6.7	45.3	18.0	8.3	67.6
	Artemisia	40.0%	TR	-	-	24.0	13.0	164.0
	Xanthocephalum sarothrae	39.0%	TR	-	-	16.0	6.6	43.0
	Juniperus	18.0%	11.5	29.0	832.0	3.0	1.2	1.5
	Pinus edulis	3.5%	TR	-	-	-	-	-
Badlands	Atriplex	12.0%	0.55	2.0	4.0	12.0	8.0	59.0

TR = Trace, <5% cover

Table 4. Vegetation profile measurements within habitat occupied by pronghorn and scaled quail.

Vegetation Type, Location or transect number	Distance of reading (meters)		Height above ground (meters) .25	.50	.75	1.00	1.25	1.50	1.75-2.50
Snakeweed/Galleta Uplands	2	$\bar{x}$	16.0[1]	trace[2]					
		S.D.	23.4						
100 meters east of Hwy 56 on County Road A4		Var.	521.5						
	4	$\bar{x}$	23.5	trace					
		S.D.	23.8						
		Var.	536.2						
	8	$\bar{x}$	33.8	trace					
		S.D.	25.7						
		Var.	627.2						
Big Sagebrush/Galleta Rolling Uplands	2	$\bar{x}$	23.1	8.5	trace				
		S.D.	30.8	20.5					
Transect Bt-1		Var.	901.0	398.4					
	4	$\bar{x}$	34.0	13.7	trace	trace (1 station)			
		S.D.	33.1	27.4					
		Var.	1041.5	715.3					
	8	$\bar{x}$	50.0	14.6	trace				
		S.D.	37.4	30.2					
		Var.	1330.0	868.4					
Greasewood/Rabbitbrush Dunes	2	$\bar{x}$	27.0	20.0	13.3	trace	trace	trace	trace
		S.D.	33.6	32.7	26.3				
Transect Bt-2		Var.	1072.5	1017.5	655.7				
	4	$\bar{x}$	41.0	28.8	17.0	trace	trace	trace	trace
		S.D.	33.0	33.5	29.0				
		Var.	1032.4	1067.2	796.8				
	8	$\bar{x}$	62.5	53.8	37.6	trace	trace	trace	trace
		S.D.	37.7	41.5	40.1				
		Var.	1348.8	1634.4	1526.3				
Snakeweed/Galleta Uplands	2	$\bar{x}$	16.1	trace					
		S.D.	20.5						
Transect Bt-9		Var.	400.8						
	4	$\bar{x}$	32.6	trace					
		S.D.	27.5						
		Var.	718.4						
	8	$\bar{x}$	48.5	trace					
		S.D.	26.4						
		Var.	662.8						

Table 4. Continued

Vegetation Type, Location or transect number	Distance of reading (meters)		Height above ground (meters) .25	.50	.75	1.00	1.25	1.50	1.75-2.50
Greasewood/Rabbitbrush Dunes	2	$\bar{x}$	50.6	31.7	31.9	16.5	trace	trace	trace
		S.D.	34.2	33.1	36.8	30.3			
Transect Bt-10		Var.	1109.7	1040.4	1288.9	874.3			
	4	$\bar{x}$	62.3	43.9	34.6	22.3	trace	trace	trace
		S.D.	38.2	37.3	40.9	35.7			
		Var.	1390.0	1325.1	1587.1	1214.3			
	8	$\bar{x}$	76.3	61.1	47.4	25.8	trace	trace	trace
		S.D.	38.9	37.5	41.5	35.3			
		Var.	1437.1	1338.3	1639.3	1185.6			
Mixed Shrub Rolling Uplands	2	$\bar{x}$	33.6	4.0	trace				
		S.D.	27.9	6.8					
Transect Bt-11		Var.	740.4	44.4					
	4	$\bar{x}$	61.2	11.1	trace	trace			
		S.D.	31.1	14.1					
		Var.	919.7	188.2					
	8	$\bar{x}$	77.2	22.9	trace	trace			
		S.D.	30.6	26.7					
		Var.	888.7	679.6					
Greasewood/Rabbitbrush Dunes	2	$\bar{x}$	22.9	9.6	trace	trace	trace		
		S.D.	32.7	22.8					
Transect Bt-12		Var.	1017.2	492.0					
	4	$\bar{x}$	32.6	14.9	trace	trace	trace		
		S.D.	37.2	24.2					
		Var.	1316.7	557.4					
	8	$\bar{x}$	53.8	25.7	trace	trace	trace		
		S.D.	37.9	38.1					
		Var.	1366.9	1384.8					
Alkali Sacaton Annual Atriplex Swale	2	$\bar{x}$	6.6	trace					
		S.D.	7.8						
		Var.	57.5						
Transect Bt-13	4	$\bar{x}$	14.4	trace					
		S.D.	13.9						
		Var.	184.1						
	8	$\bar{x}$	29.2	trace	trace				
		S.D.	23.5						
		Var.	523.2						

Table 4. Continued

Vegetation Type, Location or transect number	Distance of reading (meters)		Height above ground (meters) .25	.50	.75	1.00	1.25	1.50	1.75-2.50
Big Sagebrush/Galleta Rolling Uplands	2	$\bar{x}$	15.0	6.4	trace				
		S.D.	22.9	17.7					
		Var.	496.6	298.0					
Transect Bt-19	4	$\bar{x}$	33.1	26.1	7.2				
		S.D.	33.9	38.6	15.8				
		Var.	1092.1	1413.9	238.7				
	8	$\bar{x}$	52.7	34.9	18.0	trace			
		S.D.	35.4	38.2	26.1				
		Var.	1193.7	1385.9	647.6				
Alkali Sacaton/Annual Atriplex Swale	2	$\bar{x}$	8.6	trace					
		S.D.	17.6						
		Var.	293.8						
Transect Bt-20	4	$\bar{x}$	16.2	trace					
		S.D.	21.8						
		Var.	451.6						
	8	$\bar{x}$	30.5	trace					
		S.D.	26.7						
		Var.	676.3						
Greasewood/Rabbitbrush Dunes	2	$\bar{x}$	16.0	trace	trace				
		S.D.	28.7						
		Var.	784.9						
Transect Bt-22	4	$\bar{x}$	29.1	13.3	trace				
		S.D.	36.7	23.9					
		Var.	1280.8	546.3					
	8	$\bar{x}$	42.9	19.1	trace	trace	trace		
		S.D.	45.3	34.1					
		Var.	1951.0	1104.7					
Mixed Shrub Rolling Upland	2	$\bar{x}$	46.3	7.9	trace				
		S.D.	40.8	18.3					
Transect Bt-24		Var.	1580.1	319.0					
	4	$\bar{x}$	58.0	11.1	trace				
		S.D.	38.1	21.0					
		Var.	1381.0	419.8					
	8	$\bar{x}$	78.0	22.0	trace				
		S.D.	28.8	30.8					
		Var.	788.5	903.5					

Table 4. Continued

Vegetation Type, Location or transect number	Distance of reading (meters)		Height above ground (meters) .25	.50	.75	1.00	1.25	1.50	1.75-2.50
Greasewood Drainage	2	$\bar{x}$	9.0	6.6	trace	trace	trace		
		S.D.	8.6	10.1					
Transect BT-38		Var.	69.9						
	4	$\bar{x}$	24.5	12.7	6.3	trace	trace	trace	trace
		S.D.	25.7	24.9	14.9				
		Var.	629.8	591.4	212.2				
	8	$\bar{x}$	51.0	27.4	22.4	13.1	trace	trace	trace
		S.D.	31.8	34.9	34.9	21.1			
		Var.	959.0	1158.1	1155.7	422.4			
Greasewood Drainage	2	$\bar{x}$	37.0	26.5	15.3	11.75	trace	trace	trace
		S.D.	38.0	32.8	27.8	27.5			
Transect BT-39		Var.	1371.3	1020.1	735.7	718.2			
	4	$\bar{x}$	47.6	38.3	22.0	20.6	trace	trace	trace
		S.D.	44.0	41.3	35.1	29.9			
		Var.	1840.1	1623.1	1173.5	853.6			
	8	$\bar{x}$	66.3	48.3	39.3	25.7	21.2	14.4	trace
		S.D.	40.4	37.7	37.1	34.7	32.8	23.4	
		Var.	1550.0	1353.2	1306.8	1145.7	1024.8	518.5	

[1]These measurements represent the amount (percent) of vegetation that covers a .25 meter square.

[2]Trace = <5% coverage.

APPENDIX B

Avian Transect Data

Table 1. Summary of avian transect data, fall 1980 sample period.

Standard Habitat Site	Species	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen/1.6 km (1 mile)
Greasewood Rabbitbrush Dune	Horned Lark	257	19.2 (12)	21.4
	Sage Sparrow	138	"	11.5
	House Wren	1	"	0.1
	Bewick's Wren	3	"	0.25
	Long-eared Owl	1	"	0.1
	House Finch	61	"	5.1
	White-crowned Sparrow	1	"	0.1
	Marsh Hawk	1	"	0.1
	Loggerhead Shrike	2	"	0.2
	Scaled Quail	22	"	1.8
	Brown Towhee	6	"	0.2
Big Sagebrush/Galleta Rolling Upland	Horned Lark	102	28.8 (18)	5.6
	Scaled Quail	8	"	0.44
Pinyon Juniper Hills	Townsend's Solitaire	53	19.2 (12)	4.4
	Dark-eyed Junco	120	"	10.0
	Plain Titmouse	11	"	0.9
	Common Flicker	2	"	0.2
	Bewick's Wren	1	"	0.1
	Mountain Bluebird	1	"	0.1
	Rock Dove	2	"	0.2
Greasewood/Alkali Sacaton Drainage	Horned Lark	154	"	12.8
	Loggerhead Shrike	3	"	0.25
	Sage Sparrow	41	"	3.4
	Bewick's Wren	8	"	0.7
	Western Meadowlark	1	"	0.1
	White-crowned Sparrow	10	"	0.8
	House Finch	84	"	7.0
	Brown Towhee	10	"	0.8
	Dark-eyed Junco	51	"	4.25
	Mountain Chickadee	1	"	0.1

Table 1. Continued

Standard Habitat Site	Species	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen/1.6 km (1 mile)
Pinyon Juniper Sagebrush Hills	Townsend's Solitaire	50	19.2 (12)	4.2
	Plain Titmouse	37	"	3.1
	Dark-eyed Junco	165	"	13.8
	Scrub Jay	1	"	0.1
	Mountain Bluebird	247	"	20.6
	Common Flicker	2	"	0.2
	American Robin	1	"	0.1
	Pine Siskin	4	"	0.25
	Bewick's Wren	8	"	0.7
	Great Horned Owl	1	"	0.1
	House Finch	150	"	12.5
	Brown Towhee	2	"	0.2
	Sage Sparrow	1	"	0.1
	Mountain Chickadee	9	"	0.75
	Pinyon Jay	55	"	4.6
	White-breasted Nuthatch	1	"	0.1
	Merlin	1	"	0.1
Snakeweed/Galleta Uplands	Horned Lark	600	"	50.0
	Loggerhead Shrike	2	"	0.2
Mixed Shrub Rolling Uplands	Horned Lark	384	19.2 (12)	32.0
	Sage Sparrow	9	"	0.75
	House Finch	6	"	0.2
	Brown Towhee	3	"	0.25
	Loggerhead Shrike	3	"	0.25
Ricegrass/Snakeweed Dunes	Horned Lark	43	9.7 (6)	7.2
	Sage Sparrow	3	"	0.5
Alkali Sacaton Annual Atriplex Swale	Horned Lark	1180	19.2 (12)	98.3
Badlands	Horned Lark	47	"	3.9

Table 2. Summary of avian transect data, winter 1981 sample period.

Standard Habitat Site	Species	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen/1.6 km (1 mile)
Greasewood Alkali Sacaton Drainage	Sage Sparrow	35	9.6 (6)	5.8
	Horned Lark	8	"	1.3
	Bewick's Wren	1	"	0.2
	Dark-eyed Junco	4	"	0.7
	White-crowned Sparrow	6	"	1.0
Snakeweed/Galleta Uplands	Horned Lark	203	"	33.8
	Common Raven	2	"	0.3
Pinyon-Juniper Hills	Dark-eyed Junco	86	"	14.3
	Townsend's Solitaire	2	"	0.3
Big Sagebrush Galleta Rolling Upland	Horned Lark	11	"	1.8
Mixed Shrub Rolling Uplands	Horned Lark	114	"	19.0
	Sage Sparrow	28	"	4.7
	Marsh Hawk	1	"	0.2
	Bewick's Wren	2	"	0.3
Badlands	Horned Lark	53	"	8.8
	House Finch	4	"	0.75
Alkali Sacaton/Annual Atriplex Swale	Horned Lark	626	"	104.3
Greasewood Rabbitbrush Dune	Horned Lark	13	"	2.2
	Sage Sparrow	18	"	3.2
	House Finch	48	"	8.0
	Common Flicker	1.2	"	0.2

Table 2. Continued

Standard Habitat Site	Species	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen/1.6 km (1 mile)
Ricegrass/Snakeweed Dunes	Horned Lark	119	9.6 (6)	19.8
Pinyon-Juniper Sagebrush Hills	Great-horned Owl	2	"	0.3
	Townsend's Solitaire	12	"	2.0
	Common Raven	1	"	0.2
	House Finch	4	"	0.7
	Plain Titmouse	17	"	2.8
	Dark-eyed Junco	57	"	9.5
	Bewick's Wren	11	"	1.8
	Mountain Bluebird	14	"	2.33
	Red-tailed Hawk	1	"	0.2

Table 3. Summary of avian transect data, spring 1981 sample period.

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Badlands	Horned Lark	40.0	0.7	28	19.2 (12)	2.3	4.2
	Rock Wren	5.7	0.7	12	"	1.0	1.8
	Say's Phoebe	3.5	0.85	3	"	0.25	0.37
	Mountain Plover	1.25	0.8	1	"	0.083	0.13
	Black-throated Sparrow	6.0	0.5	3	"	0.25	0.63
	Brewer's Sparrow	6.67	0.45	3	"	0.25	0.7
	Sage Thrasher	1.42	0.71	1	"	0.083	0.15
	Mourning Dove	20.0	0.15	3	"	0.25	2.1
	Sage Sparrow	20.0	0.05	1	"	0.083	2.1
Greasewood/Alkali Sacaton Drainage	Cooper's Hawk	20.0	0.05	1	"	0.083	2.1
	Rock Wren	5.45	0.55	3	"	0.25	0.57
	Black-throated Sparrow	74.28	0.40	30	"	2.5	7.9
	Horned Lark	43.64	0.52	23	"	1.92	4.6
	Green-tailed Towhee	100.0	0.12	12	"	1.0	10.5
	Brewer's Sparrow	480.0	0.22	108	"	9.0	51.5
	Sage Sparrow	120.0	0.2	24	"	2.0	12.6

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/Alkali Sacaton Drainage - Cont.	Common Raven	2.1	0.95	2	19.2 (12)	0.16	0.22
	Mountain Bluebird	4.44	0.45	2	"	0.16	0.46
	Sage Thrasher	14.54	0.69	10	"	0.83	1.52
	Western Meadowlark	18.18	0.55	10	"	0.83	1.9
	Mockingbird	60.0	0.167	10	"	0.83	1.3
	Loggerhead Shrike	3.16	0.95	3	"	0.25	0.33
	Lark Sparrow	37.5	0.5	19	"	1.58	4.0
	White-crowned Sparrow	360.0	0.075	27	"	2.25	37.8
	Chipping Sparrow	40.0	0.05	2	"	0.16	4.2
	Northern Oriole	11.43	0.35	4	"	0.33	1.2
	Western Kingbird	3.64	0.55	2	"	0.16	0.38
	House Finch	7.5	0.4	3	"	0.25	0.78
	Virginia's Warbler	10.0	0.1	1	"	0.083	1.0
	Bewick's Wren	11.43	0.35	4	"	0.33	1.2
	Yellow-headed Blackbird	3.33	0.3	1	"	0.083	0.35
	Brown-headed Cowbird	13.33	0.45	6	"	0.5	1.4

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/Alkali Sacaton Drainage - Cont.	Black-tailed Gnatcatcher	20.0	0.05	1	19.2 (12)	0.083	2.1
	Plain Titmouse	2.86	0.35	1	"	0.083	0.3
	Prairie Falcon	2.0	0.5	1	"	0.083	0.21
	Brown Towhee	3.64	0.55	3	"	0.25	0.38
	Killdeer	2.22	0.45	1	"	0.083	0.23
Ricegrass Snakeweed Dunes	Horned Lark	360.0	0.39	141	9.6 (6)	23.5	38.0
	Mourning Dove	80.0	0.175	14	"	2.33	8.4
	Say's Phoebe	2.0	0.5	1	"	0.16	0.21
	Western Meadowlark	3.64	0.824	3	"	0.5	0.38
	Brewer's Sparrow	20.0	0.3	6	"	1.0	2.1
	Black-throated Sparrow	16.0	0.5	8	"	1.33	1.68
	Bendire's Thrasher	20.0	0.05	1	"	0.16	2.1
Snakeweed/Galleta Uplands	Horned Lark	1020.0	0.34	347	19.2 (12)	28.9	107.2
	Western Meadowlark	20.0	0.95	19	"	1.58	2.1
	Black-throated Sparrow	60.0	0.27	16	"	1.34	6.2
	Bendire's Thrasher	1.8	0.55	1	"	0.083	0.2

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Snakeweed/Galleta Uplands - Cont.	Lark Sparrow	3.64	0.55	2	19.2 (12)	0.16	0.38
	Say's Phoebe	2.0	1.0	2	"	0.16	0.21
	Mountain Bluebird	5.0	0.4	2	"	0.16	0.52
	Rock Wren	5.0	0.2	1	"	0.083	0.52
	Mourning Dove	2.5	0.4	1	"	0.083	0.26
	Sage Sparrow	3.6	0.55	2	"	0.16	0.38
	Loggerhead Shrike	2.5	0.8	2	"	0.16	0.26
	American Kestrel	6.67	0.3	2	"	0.16	0.14
	House Wren	40.0	0.05	2	"	0.16	4.2
	Sage Thrasher	1.33	0.75	1	"	0.083	0.14
	Brewer's Sparrow	2.66	0.75	2	"	0.16	0.28
	House Finch	5.7	0.35	2	"	0.16	0.60
	Burrowing Owl	6.67	0.15	1	"	0.083	0.14
Alkali Sacaton Annual Atriplex Swale	Horned Lark	1540.0	0.29	450	"	37.5	163
	Loggerhead Shrike	2.85	0.70	2	"	0.16	0.3

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Alkali Sacaton Annual Atriplex Swale - Cont.	Western Meadowlark	12.0	0.91	13	19.2 (12)	1.08	1.5
	Mockingbird	1.8	0.55	1	"	0.083	0.19
	House Finch	23.3	0.30	7	"	0.58	2.45
	Black-throated Sparrow	10.0	0.1	1	"	0.083	1.05
	Common Raven	1.8	0.55	1	"	0.083	0.19
Greasewood Rabbitbrush Dunes	Lark Sparrow	120.0	0.15	18	"	1.5	10.0
	Bendire's Thrasher	28.0	0.53	14	"	1.16	2.77
	Brewer's Blackbird	4.0	0.5	2	"	0.16	0.42
	Loggerhead Shrike	3.0	1.0	6	"	0.5	0.63
	Sage Sparrow	16.4	0.61	10	"	0.83	1.72
	Black-throated Sparrow	48.6	0.51	25	"	2.1	5.15
	Green-tailed Towhee	40.0	0.1	5	"	4.2	4.16
	Brown Towhee	10.0	0.1	1	"	0.083	13.6
	Brewer's Sparrow	33.34	0.83	40	"	3.33	5.06
	Say's Phoebe	5.5	0.72	4	"	0.33	0.58
	Horned Lark	69.0	0.78	54	"	4.5	7.3

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/ Rabbitbrush Dunes - Cont.	Yellow Warbler	40.0	0.05	2	19.2 (12)	0.16	4.2
	Empidonax	20.0	0.05	1	"	0.083	2.1
	White-crowned Sparrow	20.0	0.25	5	"	0.41	2.1
	Mourning Dove	29.0	0.48	14	"	1.16	3.1
	Western Meadowlark	7.3	0.68	1	"	0.083	2.0
	Mockingbird	30.0	0.3	9	"	0.75	3.15
	Scaled Quail	40.0	0.075	3	"	0.25	4.2
	Chipping Sparrow	20.0	0.2	4	"	0.33	2.1
	Clay-colored Sparrow	60.0	0.08	5	"	0.41	6.56
	Bewick's Wren	13.34	0.15	2	"	0.16	1.4
	House Finch	7.2	0.69	5	"	0.41	0.76
	Rock Wren	2.5	0.8	2	"	0.16	0.26
Mixed Shrub Rolling Upland	Horned Lark	660.0	0.33	220	"	18.34	69.9
	Black-throated Sparrow	160.0	0.24	39	"	3.25	17.0
	Western Meadowlark	10.9	0.64	7	"	0.58	1.1
	Brewer's Sparrow	82.85	0.49	41	"	3.41	1.8

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Mixed Shrub Rolling Upland Cont.	Mourning Dove	6.0	0.5	3	19.2 (12)	0.25	0.63
	Loggerhead Shrike	4.0	0.75	3	"	0.25	0.42
	Scaled Quail	1.82	0.55	1	"	0.083	0.2
	Chipping Sparrow	20.0	0.30	6	"	0.5	2.1
	Rock Wren	10.0	1.0	10	"	0.83	1.0
	Say's Phoebe	20.0	0.4	8	"	0.66	2.1
	House Finch	6.66	0.3	2	"	0.16	0.7
	Sage Sparrow	3.33	0.3	1	"	0.083	0.35
	Bewick's Wren	20.0	0.05	1	"	0.083	2.1
	Common Raven	1.33	0.75	1	"	0.083	0.14
Big Sagebrush/ Galleta Rolling Uplands	Brewer's Sparrow	1040.0	0.29	300	"	71.7	25.0
	Meadowlark	11.25	0.8	9	"	0.78	0.75
	Horned Lark	220.0	0.41	123	"	15.36	10.25
	Sage Sparrow	400.0	0.40	160	"	28.2	13.33
	Burrowing Owl	6.67	0.45	3	"	0.47	0.25
	Loggerhead Shrike	4.6	0.87	5	"	0.32	0.416

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Big Sagebrush/ Galleta Rolling Uplands - Cont.	Sage Thrasher	14.5	0.62	9	19.2 (12)	1.0	0.75
	Black-throated Sparrow	7.27	0.55	4	"	0.5	0.33
	Scaled Quail	3.63	1.1	4	"	0.27	0.33
	Brewer's Blackbird	3.63	0.55	2	"	0.25	0.16
	Say's Phoebe	3.63	0.55	2	"	0.25	0.16
	Mourning Dove	20.0	0.05	3	"	2.1	0.25
	Bendire's Thrasher	4.44	0.45	2	"	3.1	0.16
	Lark Sparrow	13.33	0.15	2	"	0.93	0.16
	Chipping Sparrow	120.0	0.15	18	"	8.4	1.5
Pinyon-Juniper Hills	Pinyon Jay	100.0	0.19	19	"	1.58	10.5
	Rock Wren	46.0	0.54	25	"	2.08	4.86
	Bewick's Wren	60.0	0.13	8	"	0.75	6.46
	Empidonax	1.42	0.71	1	"	0.083	0.15
	Rufous-sided Towhee	4.44	0.91	4	"	0.33	0.46
	Chipping Sparrow	23.0	0.43	10	"	0.83	2.44
	Mourning Dove	5.0	1.0	5	"	0.41	0.525

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper Hills - Cont.	Hutton's Vireo	3.6	0.55	2	19.2 (12)	0.16	0.38
	Plain Titmouse	40.0	0.125	5	"	0.41	4.2
	Say's Phoebe	10.0	0.1	1	"	0.083	1.05
	Ash-throated Flycatcher	10.0	0.3	3	"	0.25	1.05
	Bushtit	20.0	0.05	1	"	0.083	2.1
	Violet-green Swallow	20.0	0.1	2	"	0.16	2.1
	Brown Towhee	16.0	0.25	4	"	0.33	1.68
	House Finch	15.0	0.4	6	"	0.5	1.58
	Green-tailed Towhee	4.44	0.45	2	"	0.16	0.46
	Mountain Bluebird	7.1	0.84	6	"	0.5	0.75
	Black-throated Sparrow	5.33	0.75	4	"	0.33	0.56
	Brown-headed Cowbird	10.0	1.1	1	"	0.083	1.05
	Meadowlark	1.8	0.55	1	"	0.083	0.19
	Broad-tailed Hummingbird	5.0	0.2	1	"	0.083	0.525

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper/ Sagebrush Hills	Green-tailed Towhee	10.0	0.2	2	19.2 (12)	0.16	1.05
	Pinyon Jay	33.0	0.61	20	"	1.6	3.44
	Yellow-rumped Warbler	50.0	0.18	9	"	0.75	5.25
	Sage Sparrow	38.0	0.47	18	"	1.5	4.02
	Sage Thrasher	60.0	0.25	15	"	1.25	6.3
	Brewer's Sparrow	31.0	0.81	25	"	2.08	3.24
	Horned Lark	5.0	1.0	5	"	0.416	0.525
	Chipping Sparrow	337.0	0.45	153	"	13.0	35.7
	American Kestrel	5.45	0.73	4	"	0.33	0.58
	Empidonax	30.0	0.5	14	"	1.16	2.94
	House Finch	40.0	0.3	12	"	1.0	4.2
	Mountain Bluebird	64.0	0.56	37	"	3.08	6.94
	Rock Wren	1.8	0.55	1	"	0.083	0.19
	Mourning Dove	12.0	0.5	6	"	0.5	1.26
	Ash-throated Flycatcher	5.0	0.4	2	"	0.16	0.525
	Bewick's Wren	56.0	0.61	34	"	2.83	0.585

Table 3. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper Sagebrush Hills Cont.	Lewis' Woodpecker	1.25	0.8	1	19.2 (12)	0.083	0.13
	Rufous-sided Towhee	20.0	0.26	13	"	1.08	5.25
	Black-tailed Gnatcatcher	40.0	0.05	9	"	0.75	18.9
	Plain Titmouse	40.0	0.50	19	"	1.58	4.0
	Say's Phoebe	2.1	0.95	2	"	0.16	0.22
	Western Meadowlark	1.8	0.55	1	"	0.083	0.19
	Gray-headed Junco	5.0	0.2	1	"	0.083	0.52
	Yellow Warbler	10.0	0.1	1	"	0.083	1.05
	Scott's Oriole	3.6	0.55	2	"	0.16	0.38
	Black-throated Sparrow	40.0	0.05	2	"	0.16	4.2
	Scrub Jay	9.1	0.55	5	"	0.416	0.95
	Townsend's Solitaire	1.8	0.55	1	"	0.083	0.19
	Hutton's Vireo	11.12	0.45	5	"	0.416	1.16
	Common Nighthawk	20.0	0.05	1	"	0.083	2.1
	Hepatic Tanager	2.22	0.45	1	"	0.083	0.23
	Bushtit	16.0	0.25	4	"	0.33	1.68

[1]Coefficient of detectability (Emlen 1971).

Table 4. Summary of avian transect data, summer 1981 sample period.

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Badlands	House Finch	10.0	1.0	10	19.2 (12)	0.8	1.05
	Horned Lark	60.0	0.67	40	"	3.3	7.6
	Rock Wren	12.73	0.55	14	"	0.6	2.67
	Say's Phoebe	3.16	0.95	3	"	0.25	0.33
	Brewer's Sparrow	1.18	0.85	1	"	0.1	0.12
	Sage Sparrow	7.27	0.55	4	"	0.3	0.76
Alkali Sacaton/ Annual Atriplex Swale	Horned Lark	980.0	0.45	432	"	36.5	101.47
	Western Meadowlark	1.0	1.0	1	"	0.1	0.11
	Mourning Dove	40.0	0.32	13	"	1.1	4.2
	Mountain Plover	5.45	0.55	3	"	0.25	0.57
	House Finch	5.0	1.0	5	"	0.4	0.52
Snakeweed/Galleta Uplands	Horned Lark	620.0	0.54	336	"	28.0	65.2
	Mountain Plover	1.82	0.55	1.2	"	0.1	0.19
	Western Meadowlark	16.36	0.92	15	"	1.25	1.7
	Say's Phoebe	1.66	0.60	1.2	"	0.1	0.17

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seer per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Snakeweed/Galleta Uplands - Cont.	Rock Wren	7.14	0.7	5	19.2 (12)	0.4	0.75
	Mockingbird	2.22	0.45	1	"	0.1	0.23
	Red-winged Blackbird	10.0	0.1	1	"	0.1	1.05
	Black-throated Sparrow	16.0	0.8	1	"	1.0	1.68
	Mourning Dove	4.0	0.25	1	"	0.1	0.42
	Mountain Bluebird	10.0	0.2	2	"	0.2	1.05
	Brewer's Sparrow	60.0	0.117	7	"	0.6	6.28
Ricegrass/ Snakeweed Dunes	Horned Lark	340.0	0.37	128	9.6 (6)	21.33	72.67
	Western Meadowlark	4.0	1.0	4	"	0.67	0.84
	Mourning Dove	12.0	0.67	8	"	1.33	2.5
	Black-throated Sparrow	32.0	0.28	9	"	1.5	6.75
	Burrowing Owl	5.0	0.2	1	"	0.17	1.05
	Sage Sparrow	5.0	0.2	1	"	0.17	1.05
	Brewer's Sparrow	20.0	0.1	2	"	0.33	4.2

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Mixed Shrub Rolling Upland	Horned Lark	620.0	0.36	222	19.2 (12)	18.5	64.67
	Black-throated Sparrow	280.0	0.21	57	"	4.75	28.67
	Sage Thrasher	3.63	0.82	3	"	0.25	0.38
	Western Meadowlark	5.0	1.0	5	"	0.416	0.52
	Brown-headed Cowbird	8.88	0.56	5	"	0.416	0.93
	Say's Phoebe	4.0	1.0	4	"	0.25	0.42
	Rock Wren	31.0	0.93	27	"	2.25	3.0
	Bewick's Wren	2.22	0.91	2	"	0.16	0.23
	Pinyon Jay	6.66	0.91	6	"	0.5	0.7
	Lark Sparrow	5.0	0.4	2	"	0.16	0.53
	Sage Sparrow	4.44	0.91	4	"	0.33	0.46
	Brewer's Sparrow	8.88	0.91	8	"	0.75	0.92
	Bendire's Thrasher	3.33	0.30	1	"	0.083	0.33
	Mourning Dove	2.22	0.91	2	"	0.16	0.23
	Mountain Plover	2.5	0.4	1	"	0.083	0.26
	Broad-tailed Hummingbird	10.0	0.1	1	"	0.083	1.0

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/ Rabbitbrush Dunes	Scaled Quail	40.0	0.25	10	19.2 (12)	0.83	4.2
	Sage Sparrow	23.0	0.39	9	"	0.75	2.43
	Horned Lark	60.0	0.72	43	"	3.58	6.2
	Mockingbird	32.0	0.5	16	"	1.33	3.36
	House Finch	14.0	0.64	8	"	0.75	1.32
	Black-throated Sparrow	20.0	0.8	16	"	1.33	2.1
	Say's Phoebe	6.25	0.8	5	"	0.416	0.65
	Bewick's Wren	8.0	0.25	2	"	0.16	0.84
	Bendire's Thrasher	15.56	0.52	8	"	0.75	1.6
	Loggerhead Shrike	5.7	0.35	3	"	0.25	0.9
	Burrowing Owl	1.33	0.75	1	"	0.083	0.14
	Sage Thrasher	11.42	0.35	4	"	0.33	1.2
	Brewer's Sparrow	13.34	0.15	2	"	0.16	1.4
	Western Meadowlark	4.28	0.71	3	"	0.25	0.09
	Lark Sparrow	9.2	0.65	4	"	0.33	0.32
	Western Wood Pewee	4.0	0.25	1	"	0.083	0.42

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/ Rabbitbrush Dunes - Cont.	Brown-headed Cowbird	20.0	0.4	8	19.2 (12)	0.75	2.1
	Mourning Dove	27.5	0.52	17	"	1.42	2.88
	Western Tanager	60.0	0.05	3	"	0.25	6.3
	Rock Wren	6.0	0.5	3	"	0.25	0.63
Greasewood/Alkali Sacaton Drainage	Western Meadowlark	10.67	0.75	8	"	0.75	1.4
	Mockingbird	47.3	0.88	40	"	3.33	4.8
	Brown-headed Cowbird	8.57	0.70	6	"	0.5	0.9
	Sage Sparrow	120.0	0.23	27	"	2.25	12.3
	Black-throated Sparrow	110.0	0.32	35	"	2.9	11.8
	Brewer's Sparrow	160.0	0.28	45	"	3.75	16.86
	Sage Thrasher	16.36	0.55	17	"	1.42	3.43
	Horned Lark	31.0	0.67	21	"	1.75	3.29
	Bendire's Thrasher	10.0	0.8	8	"	0.75	1.0
	Lark Sparrow	120.0	0.083	10	"	0.83	12.67
	Rock Wren	40.0	0.3	12	"	1.0	4.2

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/Alkali-Sacaton Drainage Cont.	Cassin's Kingbird	2.0	1.0	2	19.2 (12)	0.16	0.21
	White-crowned Sparrow	13.34	0.59	6	"	0.5	1.1
	Mourning Dove	26.67	0.15	6	"	0.5	4.2
	Say's Phoebe	7.27	0.4	7	"	0.58	1.83
	American Kestrel	2.8	0.35	1	"	0.083	0.3
	Loggerhead Shrike	5.45	0.73	4	"	0.33	0.56
	Chipping Sparrow	2.22	0.45	1	"	0.083	0.23
	Brewer's Blackbird	2.5	0.4	1	"	0.083	0.53
	Empidonax	20.0	0.05	1	"	0.083	2.1
	Scaled Quail	5.7	0.35	2	"	0.16	0.6
	Bewick's Wren	4.0	0.75	3	"	0.25	0.42
	House Finch	3.6	0.55	2	"	0.16	0.38
	Blue Grosbeak	2.22	0.45	1	"	0.083	0.23
	Green-tailed Towhee	6.66	0.15	1	"	0.083	0.07
	Brown Towhee	4.0	0.25	1	"	0.083	0.42

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Big Sagebrush/ Galleta Rolling Uplands - Cont.	Horned Lark	109.1	0.69	75	28.8 (18)	4.17	7.66
	Sage Thrasher	5.33	0.93	5	"	0.28	0.376
	Brewer's Sparrow	185.0	0.54	98	"	5.44	12.67
	Sage Sparrow	660.0	0.39	257	"	14.28	46.0
	Western Meadowlark	4.71	0.84	4	"	0.22	0.33
	Loggerhead Shrike	3.75	0.8	3	"	0.17	0.26
	Scaled Quail	20.0	0.05	1	"	0.05	1.4
	Black-throated Sparrow	1.33	0.75	1	"	0.05	0.093
	Mourning Dove	20.0	0.35	6	"	0.33	1.8
	Common Nighthawk	4.0	0.5	2	"	0.11	0.28
Pinyon-Juniper Hills - Cont.	Rock Wren	74.55	0.7	52	19.2 (12)	4.3	7.8
	Pinyon Jay	70.0	0.33	2	"	2.0	1.6
	Ash-throated Flycatcher	23.33	0.47	11	"	0.9	3.1
	Plain Titmouse	60.0	0.23	14	"	1.2	6.3
	Broad-tailed Hummingbird	20.0	0.05	1	"	0.1	2.1
	House Finch	11.11	0.63	17	"	1.4	2.8

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper Hills - Cont.	Clay-colored Sparrow	70.0	0.2	14	19.2 (12)	1.2	7.35
	Brown-headed Cowbird	7.5	0.8	6	"	0.5	0.78
	Black-throated Sparrow	120.0	0.16	19	"	1.6	12.6
	Cassin's Kingbird	2.35	0.85	2	"	0.2	0.25
	Rufous-sided Towhee	1.0	1.0	1	"	0.1	0.1
	Canyon Wren	1.18	0.85	1	"	0.1	0.12
	Scrub Jay	40.0	0.1	4	"	0.3	4.2
	Long-eared Owl	20.0	0.1	2	"	0.2	2.1
	Mourning Dove	20.0	0.25	5	"	0.4	2.1
	Brown Towhee	8.89	0.56	5	"	0.4	0.9
	Mockingbird	9.09	0.55	5	"	0.4	0.95
	Common Bushtit	80.0	0.06	5	"	0.4	8.33
	Violet-green Swallow	12.73	0.55	17	"	1.4	1.4
	Bewick's Wren	13.33	0.53	17	"	1.4	1.4
	Loggerhead Shrike	10.00	0.3	3	"	0.25	1.0
	Horned Lark	16.36	0.61	10	"	0.8	1.7

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper Hills - Cont.	*Empidonax* Flycatcher	2.22	0.90	2	19.2 (12)	0.2	0.23
	Lark Sparrow	3.33	0.3	1	"	0.1	0.35
	Say's Phoebe	20.0	0.05	1	"	0.1	2.1
Pinyon-Juniper Sagebrush Hills	Great Horned Owl	5.0	0.8	4	"	0.3	0.53
	Rock Wren	6.66	0.75	3	"	0.4	0.7
	Scrub Jay	9.09	0.55	4	"	0.4	0.95
	Common Flicker	5.71	0.53	3	"	0.25	0.6
	Common Nighthawk	10.0	0.1	6	"	0.5	1.05
	House Finch	29.09	0.55	15	"	1.3	3.05
	Broad-tailed Hummingbird	20.0	0.05	1	"	0.1	2.1
	Mockingbird	3.16	0.95	3	"	0.25	0.33
	Lark Sparrow	30.0	0.13	4	"	0.3	3.15
	Cassin's Sparrow	21.82	0.64	14	"	1.2	2.39
	Violet-green Swallow	1.0	1.0	1	"	0.1	0.105
	Rose-breasted Grosbeak	3.33	0.3	1	"	0.1	0.35
	Say's Phoebe	4.28	0.7	3	"	0.25	0.49

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper/ Sagebrush Hills Cont.	Common Raven	1.33	0.75	1	19.2 (12)	0.1	0.03
	Black-headed Grosbeak	20.0	0.2	2	"	0.2	1.05
	Yellow-rumped Warbler	8.0	0.25	2	"	0.2	0.84
	Black-throated Sparrow	13.33	0.6	8	"	0.7	1.4
	Scott's Oriole	3.0	1.0	3	"	0.25	0.31
	Sage Sparrow	240.0	0.27	63	"	5.25	24.7
	Empidonax Flycatcher	26.67	0.41	11	"	0.9	0.57
	Mountain Bluebird	200.0	0.23	45	"	3.8	21.0
	Rufous-sided Towhee	14.44	1.04	15	"	1.25	1.6
	Ash-throated Flycatcher	21.43	0.75	15	"	1.3	2.25
	Plain Titmouse	33.33	0.57	14	"	1.16	3.5
	Sage Thrasher	12.73	0.79	10	"	0.8	1.34
	Clay-colored Sparrow	280.0	0.13	36	"	3.0	29.43
	Mourning Dove	20.0	0.3	6	"	0.5	2.1
	Pinyon Jay	27.27	0.84	23	"	1.9	2.86
	American Kestrel	1.11	0.9	1	"	0.1	0.12

Table 4. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper Sagebrush Hills Cont.	Bewick's Wren	80.0	0.31	25	19.2 (12)	2.1	8.38
	Chipping Sparrow	200.0	0.31	60	"	5.1	21.0
	Bewick's Sparrow	120.0	0.13	15	"	1.3	12.6
	Brown-headed Cowbird	10.67	0.94	10	"	0.8	1.12
	Hutton's Vireo	50.0	0.18	9	"	0.75	5.25
	White-crowned Sparrow	3.33	0.6	2	"	0.2	0.35
	Bendire's Thrasher	3.33	0.3	1	"	0.1	0.35
	Western Tanager	2.35	0.85	2	"	0.2	0.25
	Wilson's Warbler	20.0	0.05	1	"	0.1	2.1
	Northern Oriole	20.0	0.05	1	"	0.1	2.1
	Western Meadowlark	1.82	0.55	1	"	0.1	0.19
	MacGillivray's Warbler	20.0	0.05	1	"	0.1	2.1

[1]Coefficient of detectability (Emlen 1971).

Table 5. Summary of avian transect data, late summer 1981 sample period.

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/ Rabbitbrush Dune	Mourning Dove	9.0	1.0	9	9.6 (6)	1.5	1.89
	Lark Sparrow	12.0	0.25	3	"	0.5	2.52
	House Finch	20.0	0.65	11	"	1.83	3.55
	Rock Wren	10.9	0.55	6	"	1.0	2.29
	Brown-headed Cowbird	4.44	0.9	4	"	0.67	0.93
	Horned Lark	1820.0	0.11	201	"	33.5	383.7*
	Black-throated Sparrow	80.0	0.15	12	"	2.0	16.8
	Say's Phoebe	20.0	0.05	1	"	0.17	4.2
	Bendire's Thrasher	8.0	0.5	4	"	0.67	1.68
	Loggerhead Shrike	2.0	1.0	2	"	0.33	0.42
	Mockingbird	8.23	0.85	7	"	1.17	1.73
	Scaled Quail	7.27	0.69	5	"	0.83	1.51
	White-crowned Sparrow						> 100.0 m
	Cassin's Kingbird						> 100.0 m

Table 5. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Alkali Sacaton/ Annual Atriplex Swale	Horned Lark	2600.0	0.19	493	9.6 (6)	82.17	544.89
	Mourning Dove	4.0	0.25	1	"	0.17	0.84
	Mountain Plover	4.2	0.95	4	"	0.66	0.88
Snakeweed/Galleta Upland	Mountain Bluebird	1.18	0.85	1	"	0.17	0.25
	Black-throated Sparrow	3.64	0.54	2	"	0.33	0.77
	Horned Lark	141.8	0.70	100	"	16.67	30.0
	Western Meadowlark	7.27	0.96	7	"	1.17	1.53
	Bendire's Thrasher	6.66	0.15	1	"	0.17	1.4
	Rock Wren	60.0	0.08	5	"	0.83	13.13
	Mourning Dove	10.0	0.1	1	"	0.17	2.1
	Bewick's Wren	80.0	0.06	5	"	0.83	17.5
	Say's Phoebe	2.5	0.4	1	"	0.17	0.53
	Pinyon Jay	2.22	0.45	1	"	0.17	0.46
	Ash-throated Flycatcher	5.0	0.6	3	"	0.5	1.05
	Loggerhead Shrike	1.43	0.69	1	"	0.17	0.3
	Plain Titmouse	1.8	0.55	1	"	0.17	0.38

Table 5. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Badlands	Say's Phoebe	2.0	1.0	2	9.6 (6)	0.33	0.41
	Rock Wren	13.33	0.675	9	"	1.5	2.79
	House Finch	2.22	0.45	1	"	0.16	0.441
	Horned Lark	6.0	0.5	3	"	0.5	1.26
Ricegrass/Snakeweed Dunes	Horned Lark	360.0	0.18	65	"	10.83	75.83
	Burrowing Owl	1.25	0.8	1	"	0.17	0.26
	Sage Sparrow	3.64	0.55	2	"	0.33	0.76
	Black-throated Sparrow	66.67	0.22	15	"	2.5	14.32
	Western Meadowlark	5.71	0.70	4	"	0.67	1.20
	Brewer's Sparrow	4.0	0.25	1	"	0.17	0.84
	Sage Thrasher	2.0	0.5	1	"	0.17	0.42
	Mourning Dove	13.33	0.15	2	"	0.33	2.80
Mixed Shrub/ Rolling Uplands	Black-throated Sparrow	25.45	0.55	14	"	2.33	5.35
	Horned Lark	280.0	0.33	93	"	15.5	59.18
	Brewer's Sparrow	12.0	0.5	6	"	1.0	2.52

Table 5. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Mixed Shrub/ Rolling Uplands Cont.	Sage Thrasher	1.33	0.75	1	9.6 (6)	0.17	0.28
	House Finch	1.33	0.75	1	"	0.17	0.28
	Mourning Dove	20.0	0.35	7	"	1.17	4.2
	Scaled Quail						100.0 m
Greasewood/Alkali Sacaton Drainage	Mockingbird	4.44	0.9	4	"	0.66	0.93
	Scaled Quail	1.43	0.70	10	"	1.6	0.3
	Black-throated Sparrow	32.5	0.49	16	"	2.66	1.4
	Brewer's Sparrow	110.0	0.19	21	"	3.5	23.2
	Horned Lark	18.82	0.85	16	"	2.66	3.9
	Sage Thrasher	9.33	0.75	7	"	1.16	1.96
	Say's Phoebe	9.47	0.95	9	"	1.5	1.99
	Brown-headed Cowbird	10.0	0.9	9	"	1.5	2.1
	Meadowlark	5.0	0.2	1	"	0.166	1.05
	Sage Sparrow	3.6	0.55	2	"	0.33	0.76
	Loggerhead Shrike	5.45	0.73	4	"	0.66	5.48

Table 5. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Greasewood/Alkali Sacaton Drainage Cont.	Brown Towhee	3.63	0.55	2	9.6 (6)	0.33	0.76
	Lark Sparrow	11.43	0.44	5	"	0.83	2.39
	Blue Grosbeak	10.0	0.2	2	"	0.33	2.1
	Cassin's Kingbird					100.0 m	
	Bendire's Thrasher	4.29	0.70	3	"	0.5	0.90
	Rock Wren	180.0	0.15	28	"	4.67	39.2
	Ash-throated Flycatcher	6.67	0.15	1	"	0.167	1.40
	House Finch	2.5	0.40	1	"	0.167	0.53
	Mourning Dove	1.11	0.90	1	"	0.167	0.23
Pinyon-Juniper Sagebrush Hills	Sage Sparrow	200.0	0.225	45	"	7.5	42.0
	Brewer's Sparrow	173.34	0.138	24	"	4.0	36.5
	Brown-headed Cowbird	6.66	0.45	3	"	0.5	1.4
	Horned Lark	25.45	0.58	15	"	2.5	5.43

Table 5. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper Sagebrush Hills	Chipping Sparrow	120.0	0.18	22	9.6 (6)	3.66	25.62
	Plain Titmouse	32.0	0.41	13	"	2.16	6.63
	Hutton's Vireo	10.0	0.1	1	"	0.16	2.0
	Mourning Dove	2.0	1.0	2	"	0.33	0.415
	Bewick's Wren	44.0	0.45	20	"	3.33	9.32
	Mountain Bluebird	6.15	0.65	4	"	0.66	1.28
	Sage Sparrow	35.0	0.42	15	"	2.5	7.5
	Rufous-sided Towhee	2.5	0.4	1	"	0.16	0.4
	Brown Towhee	15.0	0.26	4	"	0.66	2.54
	Ash-throated Flycatcher	5.33	0.75	4	"	0.66	1.11
	Cassin's Kingbird	3.5	0.85	3	"	0.5	0.74
	Empidonax	4.0	0.75	3	"	0.5	0.84
	Brewer's Sparrow	20.0	0.55	11	"	1.83	4.19
	Scrub Jay	1.8	0.55	1	"	0.16	0.366
	Sage Thrasher	1.42	0.71	1	"	0.16	0.284
	Mockingbird	20.0	0.1	2	"	0.33	4.15

Table 5. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper/ Sagebrush Hills Cont.	Scott's Oriole	2.85	0.35	1	9.6 (6)	0.16	0.576
	House Finch	9.1	0.66	6	"	1.0	1.90
	Bendire's Thrasher	5.0	0.8	4	"	0.66	1.04
	Common Bushtit	2.5	0.4	1	"	0.16	0.504
	Black-throated Sparrow	60.0	0.22	13	"	2.16	12.4
	Loggerhead Shrike	13.33	0.15	2	"	0.33	2.8
	Rock Wren	20.0	0.25	5	"	0.83	4.18
Pinyon-Juniper Hills	Rock Wren	22.67	0.84	19	"	3.17	4.75
	Pinyon Jay	2.22	0.45	1	"	0.17	0.46
	Ash-throated Flycatcher	5.0	0.6	3	"	0.5	1.0
	Loggerhead Shrike	1.43	0.70	1	"	0.17	0.30
	Plain Titmouse	3.64	0.55	2	"	0.33	0.76
	Empidonax Flycatcher	5.0	0.2	1	"	0.17	1.0
	Mountain Bluebird	20.0	0.35	7	"	1.17	4.2
	Hutton's Vireo	4.0	0.25	1	"	0.17	0.84

Table 5. Continued

Standard Habitat Site	Species	Projected Pop. to to 100 m	C.D.[1]	# Birds Seen to 100 m	# Kilometers (miles) Censused	# Birds Seen per 1.6 km (mile)	# Birds per 40 ha (100 acres)
Pinyon-Juniper Hills Cont.	Bewick's Wren	60.0	0.12	7	9.6 (6)	1.17	12.25
	Mourning Dove	3.75	0.8	3	"	0.5	0.78
	House Finch	10.91	0.73	8	"	1.33	2.3
	Western Meadowlark	2.35	0.85	2	"	0.33	0.49
	Say's Phoebe	8.57	0.35	3	"	0.5	1.8
	Horned Lark	7.5	0.4	3	"	0.5	1.57
	Chipping Sparrow	5.45	0.55	3	"	0.5	1.15
	Scrub Jay	2.67	0.75	2	"	0.33	0.56

[1]Coefficient of detectability (Emlen 1971).

Table 6. Species of birds observed on each transect.

Transect		Species
BT-1	Big sagebrush/galleta rolling upland	Golden eagle Scaled quail Burrowing owl Horned lark Common raven Sage thrasher Loggerhead shrike Western meadowlark Black-throated sparrow Sage sparrow Brewer's sparrow
BT-2	Greasewood/rabbitbrush dune	Scaled quail Burrowing owl Horned lark House wren Mockingbird Sage thrasher Bendire's thrasher Loggerhead shrike Western meadowlark Brown-headed cowbird House finch Green-tailed towhee Black-throated sparrow Sage sparrow Brewer's sparrow
BT-3	Big sagebrush/galleta rolling upland	Red-tailed hawk Scaled quail Say's phoebe Horned lark Bendire's thrasher Lark sparrow Black-throated sparrow Sage sparrow Brewer's sparrow
BT-4	Badlands	Mountain plover Say's phoebe Horned lark Rock wren Black-throated sparrow

Table 6. Continued

Transect		Species
BT-6	Alkali sacaton/annual atriplex swale	Mourning dove Horned lark Loggerhead shrike Western meadowlark
BT-7	Ricegrass/snakeweed dune	Mourning dove Horned lark Sage thrasher Bendire's thrasher Western meadowlark Black-throated sparrow Sage sparrow Brewer's sparrow
BT-8	Mixed shrub rolling upland	Mountain plover Mourning dove Broad-tailed hummingbird Horned lark Common raven Western meadowlark Black-throated sparrow Brewer's sparrow
BT-9	Snakeweed/galleta upland	Scaled quail Mountain plover Burrowing owl Horned lark Loggerhead shrike Black-throated sparrow
BT-10	Greasewood/rabbitbrush dune	Marsh hawk Scaled quail Mourning dove Say's phoebe Western wood pewee Horned lark Mockingbird Bendire's thrasher Loggerhead shrike Western meadowlark Brewer's blackbird Brown-headed cowbird Green-tailed towhee Brown towhee Lark sparrow Sage sparrow Brewer's sparrow

Table 6. Continued

Transect		Species
BT-11	Mixed shrub rolling upland	Marsh hawk Scaled quail Mourning dove Horned lark Bewick's wren Sage thrasher Bendire's thrasher Loggerhead shrike House finch Black-throated sparrow Sage sparrow Chipping sparrow Brewer's sparrow
BT-12	Greasewood/rabbitbrush dune	Prairie falcon Scaled quail Mourning dove Long-eared owl Common flicker Cassin's kingbird Say's phoebe Horned lark Bewick's wren Mockingbird Bendire's thrasher Loggerhead shrike Western meadowlark Brown-headed cowbird House finch Black-throated sparrow White-crowned sparrow
BT-13	Alkali sacaton/annual atriplex swale	Scaled quail Horned lark Mockingbird Western meadowlark House finch
BT-14	Alkali sacaton/annual atriplex swale	Mourning dove Horned lark Western meadowlark House finch Black-throated sparrow

Table 6. Continued

Transect		Species
BT-15	Pinyon-juniper/sagebrush hills	Mourning dove
		Great-horned owl
		Cassin's kingbird
		Ash-throated flycatcher
		Say's phoebe
		Empidonax
		Scrub jay
		Pinyon jay
		Common raven
		Plain titmouse
		Common bushtit
		Bewick's wren
		Rock wren
		Mockingbird
		Sage thrasher
		Bendire's thrasher
		Townsend's solitaire
		Mountain bluebird
		Yellow warbler
		Yellow-rumped warbler
		MacGillivray's warbler
		Wilson's warbler
		Western meadowlark
		Brown-headed cowbird
		Scott's oriole
		Northern oriole
		Western tanager
		Black-headed grosbeak
		House finch
		Green-tailed towhee
		Rufous-sided towhee
		Brown towhee
		Lark sparrow
		Black-throated sparrow
		Sage sparrow
		Dark-eyed junco
		Chipping sparrow
		Gray-headed junco
		Brewer's sparrow
BT-16	Pinyon-juniper/sagebrush hills	Merlin
		Cassin's kingbird
		Horned lark
		Pinyon jay
		Sage thrasher
		Black-throated sparrow
		Sage sparrow
		Brewer's sparrow

Table 6. Continued

Transect		Species
BT-17	Badlands	Mourning dove Say's phoebe Horned lark Rock wren Sage thrasher Black-throated sparrow Sage sparrow Brewer's sparrow
BT-18	Badlands	Say's phoebe Horned lark Rock wren
BT-19	Big sagebrush/galleta rolling upland	American kestrel Scaled quail Say's phoebe Horned lark Pinyon jay Rock wren Sage thrasher Loggerhead shrike Brewer's blackbird Sage sparrow Brewer's sparrow
BT-20	Alkali sacaton/annual atriplex swale	Mountain plover Horned lark Common raven Western meadowlark
BT-21	Ricegrass/snakeweed dune	Mourning dove Burrowing owl Say's phoebe Horned lark Sage sparrow
BT-22	Greasewood/rabbitbrush dune	Golden eagle Scaled quail Mourning dove Say's phoebe *Empidonax* Horned lark Bewick's wren Rock wren Bendire's thrasher Loggerhead shrike Yellow warbler

Table 6. Continued

Transect		Species
BT-22	Greasewood/rabbitbrush dune Continued	Brown-headed cowbird Western tanager House finch Green-tailed towhee Lark sparrow Black-throated sparrow Sage sparrow Chipping sparrow Clay-colored sparrow Brewer's sparrow White-crowned sparrow
BT-23	Badlands	Say's phoebe Horned lark Rock wren House finch
BT-24	Mixed shrub rolling upland	Mourning dove Horned lark Western meadowlark House finch Black-throated sparrow Sage sparrow Brewer's sparrow
BT-25	Snakeweed/galleta upland	Horned lark Western meadowlark House finch Black-throated sparrow Brewer's sparrow
BT-26	Pinyon-juniper/sagebrush hills	American kestrel Mourning dove Common nighthawk Broad-tailed hummingbird Common flicker Cassin's kingbird Ash-throated flycatcher Say's phoebe Empidonax Violet-green swallow Scrub jay Pinyon jay Common raven Plain titmouse Common bushtit Bewick's wren

Table 6. Continued

Transect		Species
BT-26	Pinyon-juniper/sagebrush hills - Continued	Rock wren
		Mockingbird
		Sage thrasher
		American robin
		Townsend's solitaire
		Mountain bluebird
		Black-tailed gnatcatcher
		Hutton's vireo
		Yellow-rumped warbler
		Brown-headed cowbird
		Rose-breasted grosbeak
		Black-headed grosbeak
		House finch
		Pine siskin
		Green-tailed towhee
		Rufous-sided towhee
		Lark sparrow
		Sage sparrow
		Dark-eyed junco
		Chipping sparrow
		Clay-colored sparrow
		Brewer's sparrow
		White-crowned sparrow
BT-27	Pinyon-juniper/sagebrush hills	Red-tailed hawk
		American kestrel
		Mourning dove
		Great-horned owl
		Common flicker
		Lewis' woodpecker
		Cassin's kingbird
		Ash-throated flycatcher
		Empidonax
		Pinyon jay
		Common raven
		Mountain chicadee
		Plain titmouse
		White-breasted nuthatch
		Bewick's wren
		Sage thrasher
		American robin
		Townsend's solitaire
		Mountain bluebird
		Black-tailed gnatcatcher
		Hutton's vireo
		Yellow-rumped warbler
		Brown-headed cowbird

Table 6. Continued

Transect		Species
BT-27	Pinyon-juniper/sagebrush hills Continued	Hepatic tanager House finch Rufous-sided towhee Brown towhee Sage sparrow Dark-eyed junco Chipping sparrow Clay-colored sparrow Brewer's sparrow
BT-28	Greasewood/alkali sacaton drainage	Cooper's hawk American kestrel Mourning dove Western kingbird Cassin's kingbird Say's phoebe Empidonax Horned lark Pinyon jay Common raven Rock wren Mockingbird Sage thrasher Bendire's thrasher Mountain bluebird Loggerhead shrike Western meadowlark Brewer's blackbird Bullock's oriole Green-tailed towhee Lark sparrow Black-throated sparrow Sage sparrow Chipping sparrow Brewer's sparrow
BT-29	Greasewood/alkali sacaton drainage	Mourning dove Cassin's kingbird Ash-throated flycatcher Say's phoebe Pinyon jay Mountain chicadee Plain titmouse Bewick's wren Rock wren Mockingbird Sage thrasher

Table 6. Continued

Transect		Species
BT-29	Greasewood/alkali sacaton drainage - Continued	Bendire's thrasher Black-tailed gnatcatcher Loggerhead shrike Western meadowlark Brown-headed cowbird Blue grosbeak House finch Green-tailed towhee Brown towhee Lark sparrow Black-throated sparrow Sage sparrow Dark-eyed junco Brewer's sparrow White-crowned sparrow
BT-30	Pinyon-juniper hills	Rock dove Mourning dove Long-eared owl Common flicker Ash-throated flycatcher Violet-green swallow Scrub jay Pinyon jay Plain titmouse Bewick's wren Rock wren Canyon wren Townsend's solitaire Mountain bluebird Brown-headed cowbird Rufous-sided towhee Dark-eyed junco
BT-31	Big sagebrush/galleta rolling upland	Mourning dove Horned lark Sage thrasher Bendire's thrasher Loggerhead shrike Western meadowlark Black-throated sparrow Sage sparrow Brewer's sparrow
BT-32	Snakeweed/galleta upland	American kestrel Mourning dove Say's phoebe

Table 6. Continued

Transect		Species
BT-32	Snakeweed/galleta upland Continued	Horned lark Common raven House wren Bewick's wren Rock wren Mockingbird Sage thrasher Bendire's thrasher Mountain bluebird Loggerhead shrike Western meadowlark Red-winged blackbird Black-throated sparrow Sage sparrow Brewer's sparrow
BT-33	Mixed shrub rolling upland	Say's phoebe Horned lark Pinyon jay Plain titmouse Bewick's wren Rock wren Mockingbird Western meadowlark Brown-headed cowbird House finch Brown towhee Lark sparrow Black-throated sparrow Sage sparrow Chipping sparrow Brewer's sparrow
BT-34	Snakeweed/Galleta Upland	Say's phoebe Horned lark Common raven Rock wren Mockingbird Bendire's thrasher Western meadowlark Lark sparrow Black-throated sparrow Brewer's sparrow

Table 6. Continued

Transect		Species
BT-35	Pinyon-juniper hills	Broad-tailed hummingbird
		Ash-throated flycatcher
		Say's phoebe
		Pinyon jay
		Common raven
		Plain titmouse
		Common bushtit
		Bewick's wren
		Rock wren
		Mockingbird
		Townsend's solitaire
		Mountain bluebird
		Loggerhead shrike
		Western meadowlark
		Brown-headed cowbird
		House finch
		Brown towhee
		Black-throated sparrow
		Dark-eyed junco
		Chipping sparrow
		Clay-colored sparrow
BT-36	Pinyon-juniper hills	Ash-throated flycatcher
		Say's phoebe
		Empidonax
		Horned lark
		Pinyon jay
		Plain titmouse
		Bewick's wren
		Rock wren
		Mockingbird
		Townsend's solitaire
		Mountain bluebird
		Loggerhead shrike
		Brown-headed cowbird
		House finch
		Green-tailed towhee
		Brown towhee
		Lark sparrow
		Black-throated sparrow
		Dark-eyed junco
		Clay-colored sparrow
BT-37	Pinyon-juniper hills	Mourning dove
		Broad-tailed hummingbird
		Cassin's kingbird
		Ash-throated flycatcher

Table 6. Continued

Transect		Species
BT-37	Pinyon-juniper hills Continued	Say's phoebe
		Empidonax
		Horned lark
		Scrub jay
		Pinyon jay
		Plain titmouse
		Common bushtit
		Bewick's wren
		Rock wren
		Townsend's solitaire
		Mountain bluebird
		Hutton's vireo
		Western meadowlark
		Brown-headed cowbird
		House finch
		Rufous-sided towhee
		Black-throated sparrow
		Dark-eyed junco
		Chipping sparrow
		Clay-colored sparrow
BT-38	Greasewood/alkali sacaton drainage	Prairie falcon
		Scaled quail
		Killdeer
		Mourning dove
		Say's phoebe
		Horned lark
		Common raven
		Bewick's wren
		Mockingbird
		Sage thrasher
		Bendire's thrasher
		Loggerhead shrike
		Western meadowlark
		Brown-headed cowbird
		House finch
		Green-tailed towhee
		Brown towhee
		Black-throated sparrow
		Sage sparrow
		Chipping sparrow
		Brewer's sparrow
		White-crowned sparrow

Table 6. Continued

Transect		Species
BT-39	Greasewood/alkali sacaton drainage	Scaled quail Mourning dove Say's phoebe Horned lark Common raven Bewick's wren Mockingbird Sage thrasher Bendire's thrasher Virginia's warbler Western meadowlark Yellow-headed blackbird Brown-headed cowbird House finch Black-throated sparrow Sage sparrow Chipping sparrow Brewer's sparrow
BT-40	Big sagebrush/galleta rolling upland	Mourning dove Common nighthawk Horned lark Common raven Sage thrasher Western meadowlark Sage sparrow Brewer's sparrow
BT-41	Big sagebrush/galleta rolling upland	Mourning dove Common nighthawk Horned lark Common raven Sage thrasher Brown-headed cowbird Sage sparrow Chipping sparrow Brewer's sparrow

APPENDIX C

Species of Mammals Trapped on Each Transect

APPENDIX C

Species of Mammals Trapped on Each Transect

Transect	Species	Voucher Specimen Taken
1 Greasewood/Rabbitbrush Dune	Ammospermophilus leucurus	X
	Dipodomys ordii	X
	Onychomys leucogaster	X
	Perognathus flavus	
	Peromyscus maniculatus	X
	Reithrodontomys megalotis	X
	Spermophilus spilosoma	X
	Thomomys bottae	X
2 Snakeweed/Galleta Uplands	Ammospermophilus leucurus	X
	Dipodomys ordii	
	Dipodomys spectabilis	X
	Onychomys leucogaster	X
	Perognathus flavus	
	Spermophilus spilosoma	X
3 Rock Outcrop	Ammospermophilus leucurus	X
	Dipodomys ordii	
	Onychomys leucogaster	
	Perognathus flavus	
	Peromyscus maniculatus	X
	Reithrodontomys megalotis	X
	Spermophilus spilosoma	
4 Mixed Shrub Rolling Upland	Dipodomys ordii	X
	Onychomys leucogaster	
	Perognathus flavescens	
	Perognathus flavus	
	Peromyscus maniculatus	
	Spermophilus spilosoma	X
	Thomomys bottae	X
5 Dry Lake Bed	Ammospermophilus leucurus	X
	Neotoma albigula	X
	Peromyscus maniculatus	X
6 Mixed Shrub Rolling Upland	Ammospermophilus leucurus	X
	Dipodomys ordii	X
	Onychomys leucogaster	X
	Perognathus flavescens	
	Perognathus flavus	
	Peromyscus maniculatus	
	Spermophilus spilosoma	X

APPENDIX C - Continued

Transect		Species	Voucher Specimen Taken
7	Badlands	Perognathus flavus	X
		Peromyscus maniculatus	X
8	Big Sagebrush/Galleta Rolling Uplands	Dipodomys ordii	X
		Onychomys leucogaster	
		Perognathus flavus	
		Peromyscus maniculatus	X
9	Greasewood/Rabbitbrush Dune	Dipodomys ordii	
		Onychomys leucogaster	X
		Perognathus flavescens	
		Perognathus flavus	
		Peromyscus maniculatus	
		Reithrodontomys megalotis	X
		Spermophilus spilosoma	
9A	Mixed Shrub Rolling Upland	Ammospermophilus leucurus	X
		Dipodomys ordii	X
		Neotoma albigula	
		Perognathus flavus	X
		Peromyscus maniculatus	X
		Reithrodontomys megalotis	
10	Badlands	Neotoma cinerea	
		Perognathus flavus	X
		Peromyscus maniculatus	X
		Reithrodontomys megalotis	
11	Big Sagebrush/Galleta Rolling Uplands	Ammospermophilus leucurus	X
		Dipodomys ordii	
		Onychomys leucogaster	
		Perognathus flavescens	
		Perognathus flavus	
13	Treated Sagebrush	Dipodomys ordii	X
		Perognathus flavus	
		Peromyscus maniculatus	X
		Spermophilus spilosoma	
15	Pinyon-Juniper/Sagebrush Hills	Ammospermophilus leucurus	
		Dipodomys ordii	
		Eutamias quadrivittatus	X
		Neotoma albigula	
		Perognathus flavescens	
		Perognathus flavus	

APPENDIX C - Continued

Transect	Species	Voucher Specimen Taken
15 Pinyon-Juniper/Sagebrush Hills - Continued	Peromyscus maniculatus	
	Peromyscus truei	X
	Spermophilus spilosoma	
16 Badlands	Neotoma albigula	X
	Peromyscus maniculatus	X
17 Alkali Sacaton/Annual Atriplex Swale	Onychomys leucogaster	
	Perognathus flavus	
	Peromyscus maniculatus	X
18 Big Sagebrush/Galleta Rolling Upland	Ammospermophilus leucurus	
	Dipodomys ordii	X
	Dipodomys spectabilis	X
	Onychomys leucogaster	X
	Perognathus flavus	X
	Peromyscus maniculatus	
	Spermophilus spilosoma	
19 Pinyon-Juniper/ Sagebrush Hills	Dipodomys ordii	X
	Eutamias quadrivittatus	X
	Perognathus flavescens	
	Perognathus flavus	
	Peromyscus maniculatus	
	Peromyscus truei	X
	Reithrodontomys megalotis	
	Spermophilus variegatus	X
20 Greasewood/Alkali Sacaton Drainage	Ammospermophilus leucurus	
	Onychomys leucogaster	
	Perognathus flavus	
	Peromyscus maniculatus	X
	Reithrodontomys megalotis	X
22 Big Sagebrush/Galleta Rolling Upland	Ammospermophilus leucurus	
	Dipodomys ordii	
	Perognathus flavus	
	Peromyscus maniculatus	X
23 Pinyon-Juniper Hills	Eutamias quadrivittatus	
	Neotoma albigula	X
	Neotoma cinerea	
	Perognathus flavus	
	Peromyscus maniculatus	
	Peromyscus truei	X
	Reithrodontomys megalotis	X

APPENDIX C - Continued

Transect	Species	Voucher Specimen Taken
24 Pinyon-Juniper Hills	Eutamias quadrivittatus	
	Neotoma albigula	X
	Peromyscus crinitus	X
	Peromyscus maniculatus	
	Peromyscus truei	X
25 Pinyon-Juniper Hills	Eutamias quadrivittatus	X
	Neotoma albigula	
	Perognathus flavus	
	Peromyscus crinitus	X
	Peromyscus maniculatus	
	Peromyscus truei	X
	Reithrodontomys megalotis	
26 Pinyon-Juniper Hills	Ammospermophilus leucurus	
	Eutamias quadrivittatus	X
	Neotoma albigula	X
	Neotoma cinerea	
	Peromyscus crinitus	X
	Peromyscus maniculatus	
	Peromyscus truei	X
27 Snakeweed/Galleta Upland	Dipodomys ordii	
	Perognathus flavus	X
	Peromyscus maniculatus	
28 Snakeweed/Galleta Upland	Dipodomys ordii	
	Onychomys leucogaster	X
	Perognathus flavus	X
	Peromyscus maniculatus	X
	Reithrodontomys megalotis	
29 Greasewood/Alakli Sacaton Drainage	Ammospermophilus leucurus	
	Perognathus flavus	X
	Peromyscus maniculatus	
	Reithrodontomys megalotis	X
30 Greasewood/Alkali Sacaton Drainage	Ammospermophilus leucurus	
	Perognathus flavus	X
	Peromyscus maniculatus	X
	Peromyscus truei	Live trapped and recaptured next day
	Reithrodontomys megalotis	X

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APPENDIX D

Alphabetical List of Species, Letter Codes, and Common Names

The following list was compiled from the BLM's list of codes for North American wildlife species. It should be noted that the scientific names of some species have changed since printing of the BLM's list and updated codes are not yet available.

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Appendix D

Alphabetical Species List, Codes and Common Names

Amphibians

Ambystoma tigrinum	AMTI	Tiger Salamander
Scaphiopus bombifrons	SCBO	Plains Spadefoot Toad
Scaphiopus hammondi	SCHA	Western Spadefoot Toad

Reptiles

Arizona elegans phillipi	ARELPH	Painted Desert Glossy Snake
Cnemidophorus inornatus	CNIN	Little Striped Whiptail
Cnemidophorus velox	CNVE	Plateau Striped Whiptail
Crotalus viridus viridus	CRVIVI	Prairie Rattlesnake
Crotaphytus collaris auriceps	CRCOAU	Yellow-headed Collared Lizard
Heterodon nasicus kennerlyi	HENAKE	Mexican Hog-nosed Snake
Holbrookia maculata approximans	HOMAAP	Speckled Earless Lizard
Masticophis taeniatus taeniatus	MATATA	Desert Striped Whipsnake
Phrynosoma douglassi ornatissimum	PHDO	Desert Short-horned Lizard
Pituophis melanoleucus	PIME	Gopher Snake
Sceloporus graciosus graciosus	SCGRAGR	Northern Sagebrush Lizard
Sceloporus undulatus elongatus	SCUNEL	Northern Plateau Lizard
Thamnophis elegans vagrans	THELVA	Wandering Garter Snake
Urosaurus ornatus wrighti	URORWR	Northern Tree Lizard
Uta stansburiana uniformis	UTSTSTE	Desert Side-blotched Lizard

Birds

Accipiter cooperii	ACCO	Cooper's Hawk
A. gentilis	ACGE	Goshawk
A. striatus	ACST	Sharp-shinned Hawk
Actitis macularia	ACMA	Spotted Sandpiper
Aeronautes saxatalis	AESA	White-throated Swift
Agelaius phoeniceus	AGPH	Red-winged Blackbird
Amphispiza belli	AMBE	Sage Sparrow
A. bilineata	AMBI	Black-throated Sparrow
Anas acuta	ANAC	Common Pintail
A. carolinensis	ANCA	American Green-wing Teal
A. cyanoptera	ANCY	Cinnamon Teal
A. discors	ANDIS	Blue-wing Teal
A. platyrhynchos	ANPL	Mallard
A. strepera	ANSTR	Gadwall
Anser caerulescens	ANCAE	Greater Snow Goose
Anthus spinoletta	ANSP	Water Pipit
Aquila chrysaetos	AQCH	Golden Eagle
Ardea herodias	ARHE	Great Blue Heron
Asio flammeus	ASFL	Short-eared Owl
A. otus	ASOT	Long-eared Owl

Birds - Continued

Asyndesmus lewis	ASLE	Lewis' Woodpecker
Aythya affinis	AYAF	Lesser Scaup
A. americana	AYAM	Redhead
Bombycilla cedrorum	BOCE	Cedar Waxwing
Bubo virginianus	BUVIR	Great Horned Owl
Buteo jamaicensis	BUJA	Red-tailed Hawk
B. lagopus	BULA	Rough-legged Hawk
B. regalis	BUREG	Ferruginous Hawk
B. swainsoni	BUSW	Swainson's Hawk
Calamospiza melanocorys	CAMEL	Lark Bunting
Calcarius lapponicus	CALAP	Lapland Longspur
Callipepla squamata	CASQ	Scaled Quail
Capella gallinago	CAGA	Common Snipe
Carpodacus mexicanus	CAMEX	House Finch
Charadrius vociferus	CHVO	Killdeer
Cathartes aura	CAAU	Turkey Vulture
Catherpes mexicanus	CAMEXI	Canyon Wren
Catoptrophorus semipalmatus	CASE	Willet
Chlidonias niger	CHNI	Black Tern
Chlorura chlorura	CHCH	Green-tailed Towhee
Chondestes grammacus	CHGR	Lark Sparrow
Chordeiles minor	CHMI	Common Nighthawk
Circus cyaneus	CICY	Marsh Hawk
Columba livia	COLI	Rock Dove
Colaptes cafer	COCA	Red-shafted Flicker
Contopus sordidulus	COSO	Western Wood Pewee
Corvus corax	COCOR	Common Raven
Dendrocopos pubescens	DEPU	Downy Woodpecker
D. villosus	DEVI	Hairy Woodpecker
Dendroica auduboni	DEAUD	Audubon's Warbler
Dendroica petechia	DEPE	Yellow Warbler
Egretta thula	EGTH	Snowy Egret
Eremophila alpestris	ERAL	Horned Lark
Erolia minutilla	ERMI	Least Sandpiper
Euphagus cyanocephalus	EUCY	Brewer's Blackbird
Eupoda montana	EUMO	Mountain Plover
Falco columbarius	FACO	Merlin
F. mexicanus	FAME	Prairie Falcon
F. sparverius	FASP	American Kestrel
Fulica americana	FUAM	American Coot
Geococcyx californianus	GECA	Greater Roadrunner
Grus canadensis	GRCA	Sandhill Crane
Guiraca caerula	GUCA	Blue Grosbeak
Gymnorhinus cyanocephalus	GYCY	Pinon Jay
Hirundo rustica	HIRU	Barn Swallow
Icterus galbula	ICGA	Northern Oriole
I. parisorum	ICPA	Scott's Oriole

Birds - Continued

Junco hyemalis	JUHY	Slate-colored Junco
Lanius ludovicianus	LALU	Loggerhead Shrike
Mimus polyglottos	MIPO	Northern Mockingbird
Molothrus ater	MOAT	Brown-headed Cowbird
Muscivora forficata	MUFO	Scissor-tailed Flycatcher
Myadestes townsendi	MYTO	Townsend's Solitaire
Myiarchus cinerascens	MYCI	Ash-throated Flycatcher
Oporornis tolmiei	OPTO	MacGillivray's Warbler
Oreoscoptes montanus	ORMO	Sage Thrasher
Otus flammeolus	OTFL	Flammulated Screech Owl
Parus gambeli	PAGA	Mountain Chickadee
P. inornatus	PAIN	Plain Titmouse
Petrochelidon pyrrhonota	PEPY	Cliff Swallow
Phalaenoptilus nuttallii	PHNU	Common Poor-will
Pheuticus ludovicianus	PHLU	Rose-breasted Grosbeak
P. melanocephalus	PHME	Black-headed Grosbeak
Pipilo erythrophthalmus	PIER	Rufous-sided Towhee
P. fuscus	PIFU	Brown Towhee
Piranga flava	PIFL	Hepatic Tanager
P. ludoviciana	PILU	Western Tanager
Plegadis chihi	PLCH	White-faced Ibis
Podiceps caspicus	POCA	Eared Grebe
Podilymbus podiceps	POPO	Pied-billed Grebe
Polioptila melanura	POME	Black-tailed Gnatcatcher
Psaltriparus minimus	PSMI	Bushtit
Regulus calendula	RECA	Ruby-crowned Kinglet
Salpinctes obsoletus	SAOBS	Rock Wren
Sayornis saya	SASA	Say's Phoebe
Selasphorus platycercus	SEPL	Broad-tailed Hummingbird
S. rufus	SERU	Rufous Hummingbird
Sialia currucoides	SICU	Mountain Bluebird
Sitta carolinensis	SICAR	White-breasted Nuthatch
Spatula clypeata	SPCL	Northern Shoveler
Speotyto cunicularia	SPCU	Burrowing Owl
Spinus pinus	SPPI	Pine Siskin
Spizella arborea	SPARB	Tree Sparrow
S. breweri	SPBRE	Brewer's Sparrow
S. pallida	SPPAL	Clay-colored Sparrow
S. passerina	SPPA	Chipping Sparrow
Steganopus tricolor	STTRI	Wilson's Phalarope
Sturnella neglecta	STNEG	Western Meadowlark
Sturnus vulgaris	STVU	Starling
Tachicineta thalassina	TATH	Violet-green Swallow
Telmatodytes palustris	TEPA	Long-billed Marsh Wren
Thryomanes bewickii	THBE	Bewick's Wren
Toxostoma bendirei	TOBE	Bendire's Thrasher
Troglodytes aedon	TRAE	House Wren

Birds - Continued

Turdus migratorius	TUMI	American Robin
Tyrannus verticalis	TYVE	Western Kingbird
T. vociferans	TYVO	Cassin's Kingbird
Vermivora virginiae	VEVI	Virginia's Warbler
Vireo huttoni	VIHU	Hutton's Vireo
Wilsonia pusilla	WIPU	Wilson's Warbler
Xanthocephalus xanthocephalus	XAXA	Yellow-headed Blackbird
Zenaidura macroura	ZEMA	Mourning Dove
Zonotrichia leucophrys	ZOLE	White-crowned Sparrow

MAMMALS

Ammospermophilus leucurus	AMLE	White-tailed Antelope Ground Squirrel
Antilocapra americana	ANAM	Pronghorn
Antrozous pallidus	ANPA	Pallid Bat
Canis latrans	CALA	Coyote
Cynomys gunnisoni	CYGU	Gunnison's Prairie Dog
Dipodomys ordii	DIOR	Ord's Kangaroo Rat
Dipodomys spectabilis	DISP	Bannertail Kangaroo Rat
Erethizon dorsatum	ERDO	Porcupine
Eutamias quadrivittatus	EUQU	Colorado Chipmunk
Felis concolor	FECO	Mountain Lion
Felis rufus	FERU	Bobcat
Lasionycteris noctivagans	LANO	Silver-haired Bat
Lepus californicus	LECA	Black-tailed Jackrabbit
Myotis yumanensis	MYYU	Yuma Myotis
Neotoma albigula	NEAL	White-throated Woodrat
Neotoma cinerea	NECI	Bushy-tailed Woodrat
Neotoma stephensi	NEST	Steven's Woodrat
Odocoileus hemionus	ODHE	Mule Deer
Onychomys leucogaster	ONLE	Northern Grasshopper Mouse
Perognathus flavescens	PEFLA	Plains Pocket Mouse
Perognathus flavus	PEFL	Silky Pocket Mouse
Peromyscus crinitus	PECR	Canyon Mouse
Peromyscus maniculatus	PEMA	Deer Mouse
Peromyscus truei	PETR	Pinyon Mouse
Pipistrellus hesperus	PIHE	Western Pipistrelle
Plecotus townsendii	PLTO	Townsend's Big-eared Bat
Reithrodontomys megalotis	REME	Western Harvest Mouse
Spermophilus spilosoma	SPSP	Spotted Ground Squirrel
Spermophilus variegatus	SPVA	Rock Squirrel
Sylvilagus audubonii	SYAU	Desert Cottontail Rabbit
Taxidea taxus	TATA	Badger
Thomomys bottae	THBO	Botta's Pocket Gopher
Vulpes macrotis	VUMA	Kit Fox
Vulpes vulpes	VUVU	Red Fox

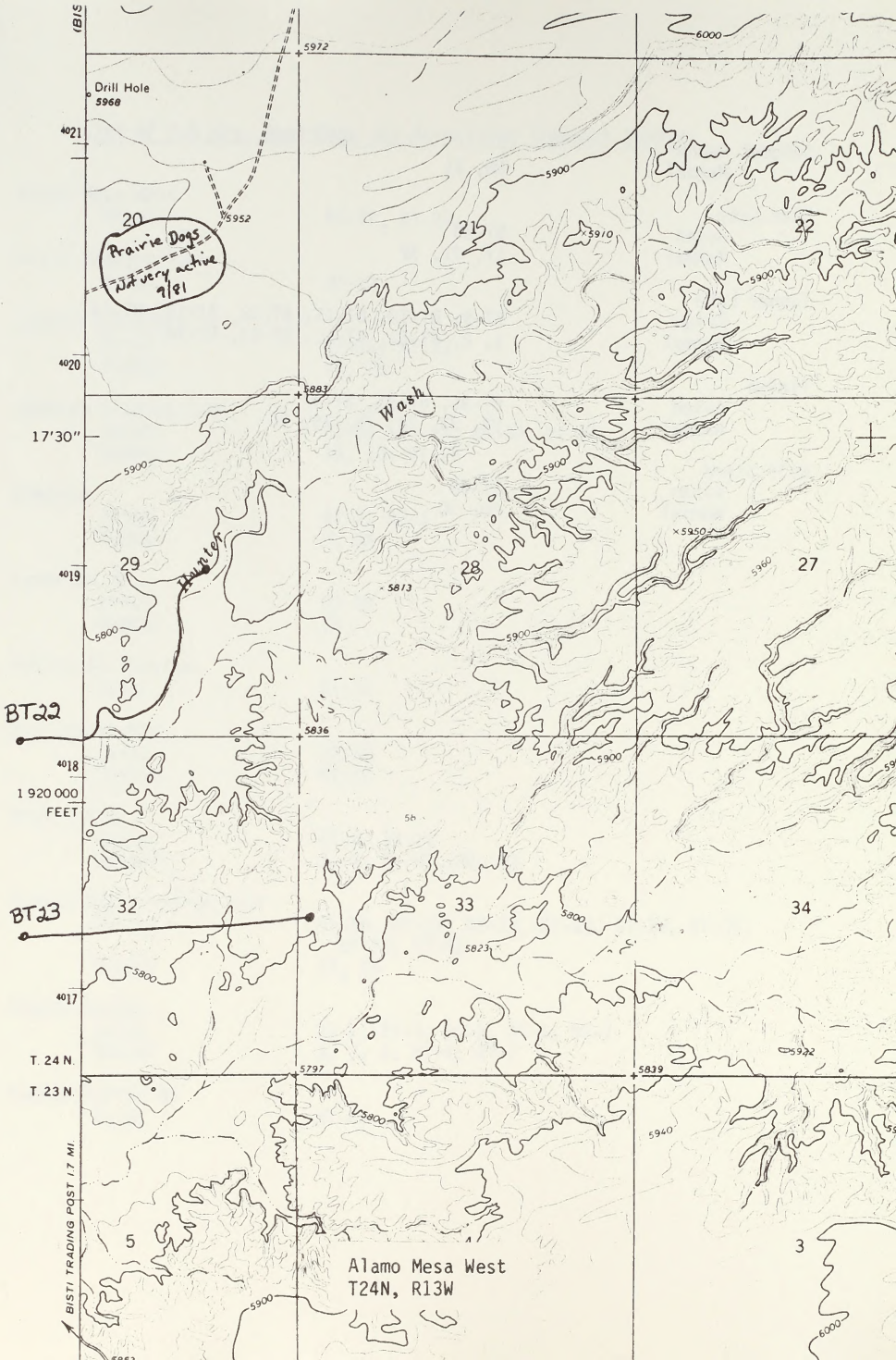
APPENDIX E

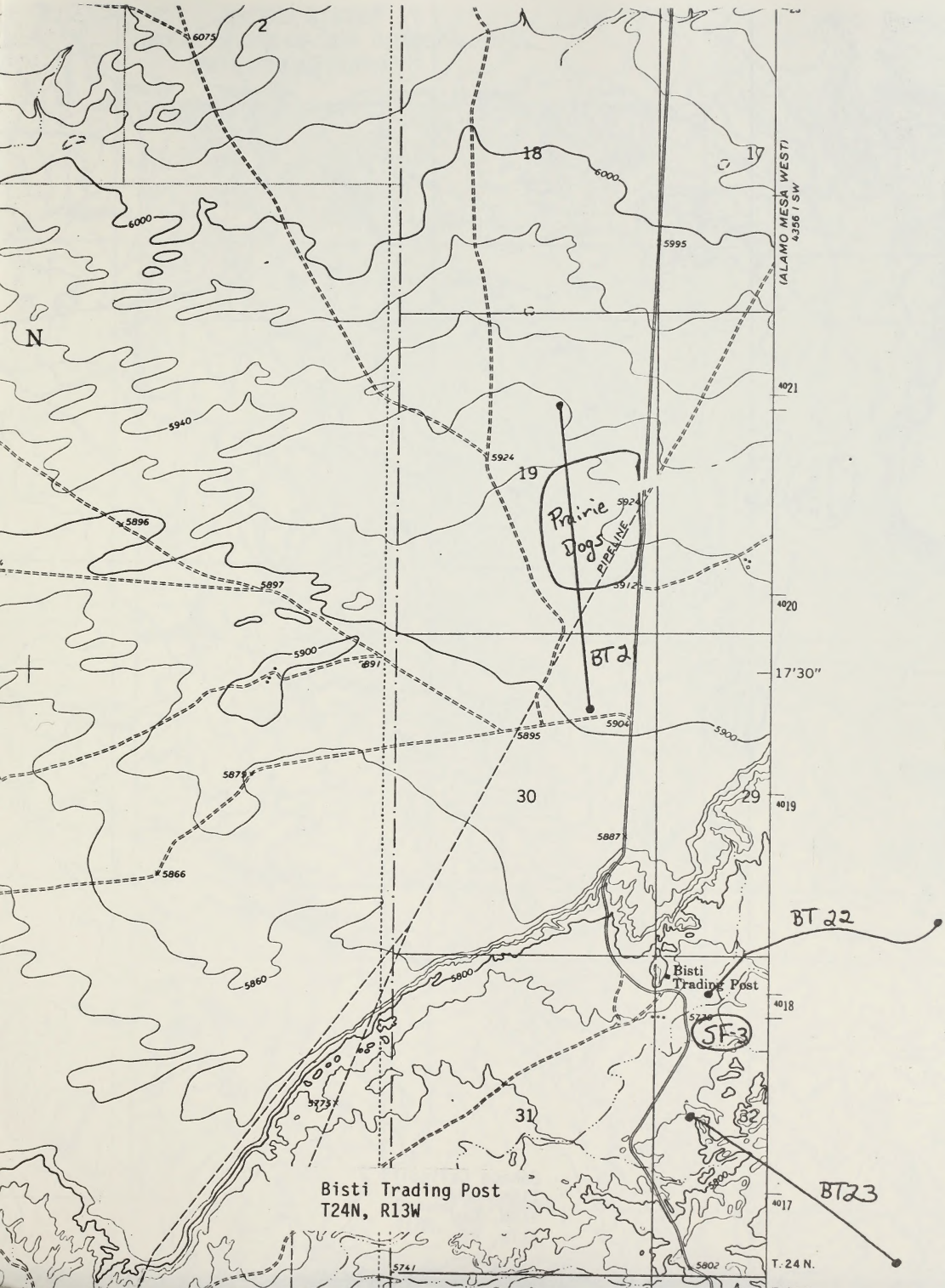
Maps and Transect Locations

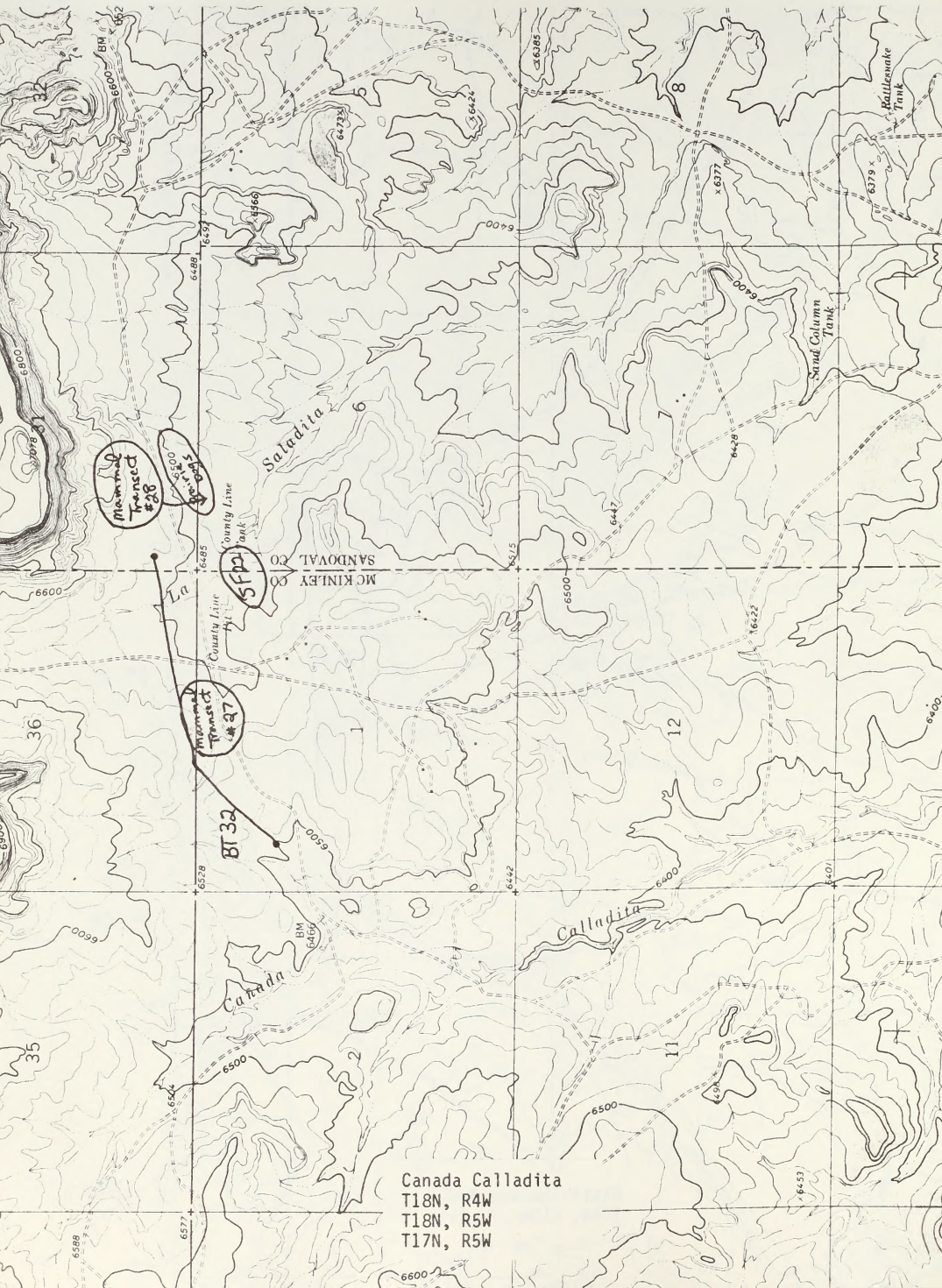
List of 7.5 min. Quad Maps and Associated Transect Numbers

Alamo Mesa West		
	Avian	BT-22, BT-23
Bisti Trading Post		
	Avian	BT-21
Canada Calladita		
	Avian	BT-32, BT-33
	Mammal	27, 28
Johnson Trading Post		
	Avian	BT-26, BT-28, BT-30, BT-31
	Mammal	18, 19, BT-28
Kimbeto		
	Avian	BT-2, BT-3
	Mammal	9, 9A
Lynbrook SE		
	Avian	BT-15
	Mammal	15
Mesita De Gavilan		
	Avian	BT-34
Ojo Encino Mesa		
	Avian	BT-27
	Mammal	BT-27
Pretty Rock		
	Avian	BT-8, BT-24
	Mammal	3, 4, 5, M1, M2, M3
Pueblo Alto Trading Post		
	Avian	BT-16, BT-17, BT-18, BT-19, BT-38, BT-39, BT-40, BT-41
	Mammal	13, 16
Pueblo Bonito		
	Avian	BT-1, BT-4, BT-5, BT-6, BT-7
	Mammal	6, 7, 8, BT-6, BT-7
Pueblo Bonito NW		
	Avian	BT-25

Sargent Ranch		
	Mammal	10, 11
Star Lake		
	Avian	BT-20
	Mammal	17, 31, 32
Tanner Lake		
	Avian	BT-9, BT-10, BT-11, BT-12, BT-13, BT-14
	Mammal	1, 2, BT-11, BT-12, BT-13, BT-14
Tinian		
	Avian	BT-35, BT-36, BT-37
	Mammal	22, 23, 24, 25, 26, 29
Wolf Stand		
	Avian	BT-29
	Mammal	20, 30


Drill Hole
5968
Prairie Dogs
Not very active
9/81
Wash
Hunter
BT22
BT23
17'30"
1 920 000
FEET
T. 24 N.
T. 23 N.
BISTI TRADING POST 1.7 MI.
Alamo Mesa West
T24N, R13W


(ALAMO MESA WEST)
4356 I SW
N
Prairie Dogs
PIPELINE
BT 21
BT 22
BT23
SF-3
Bisti Trading Post
17'30"
T. 24 N.
Bisti Trading Post
T24N, R13W

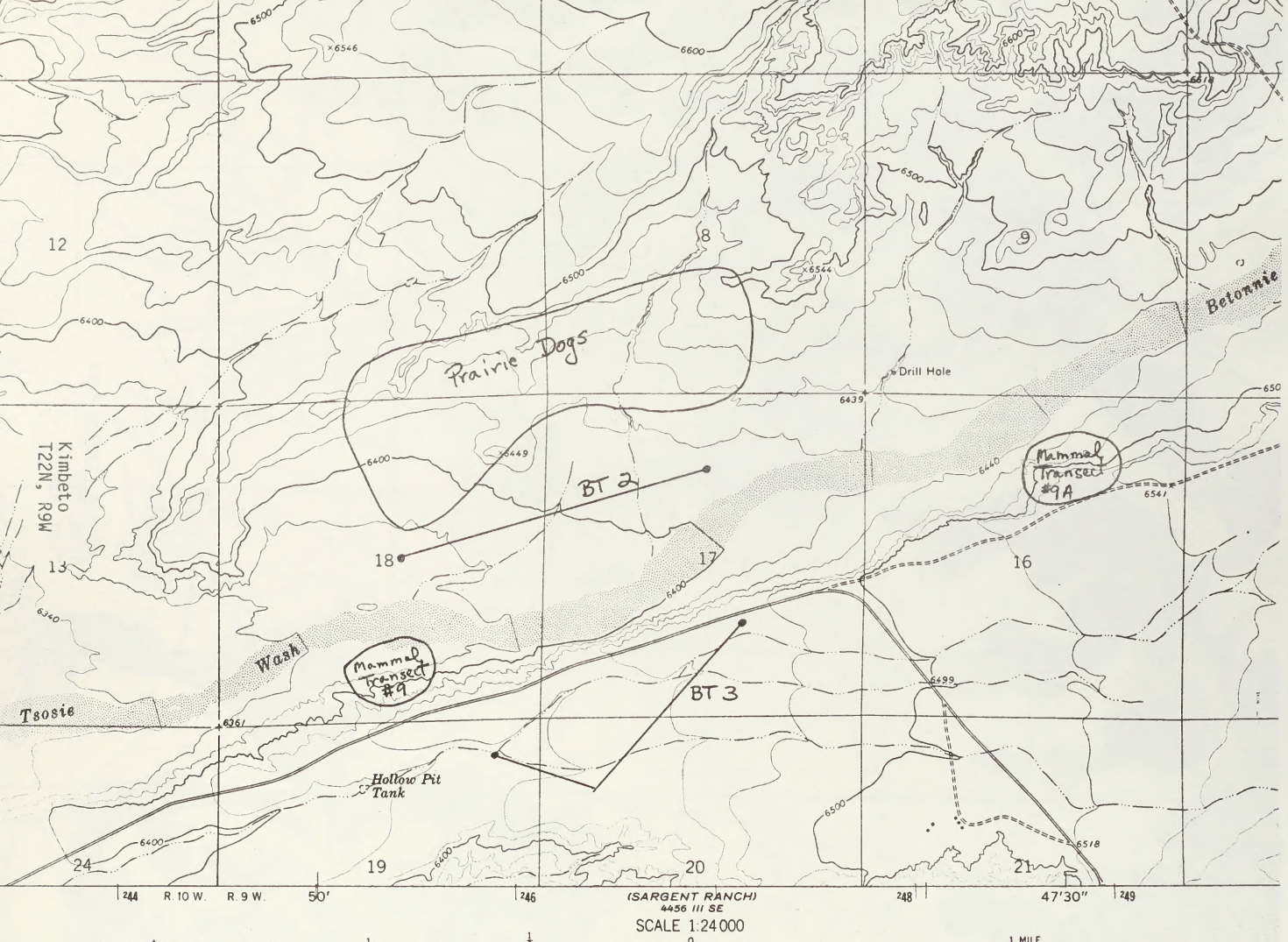


Canada Calladita
T18N, R4W
T18N, R5W
T17N, R5W

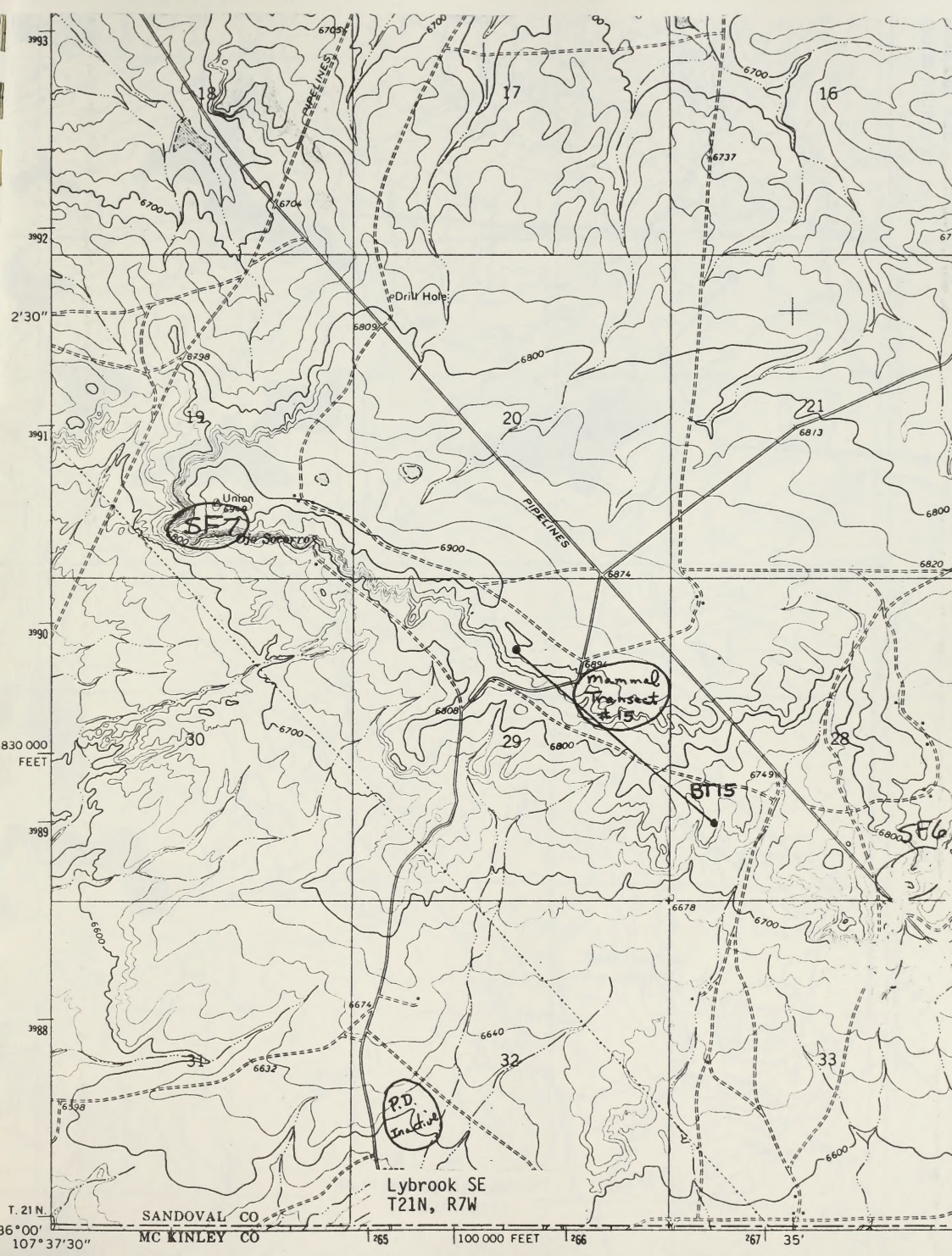
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
107°22'30"
286000m. E.
1 720 000 FEET (CENTRAL)
20'
35°45'
3958000m. N.
BT 33
T. 18 N.
T. 17 N.
1 720 000 FEET (CENTRAL)
42'30"
Cholla Tank
Saddle Tank
Canada
Canada Calladita
T18N, R5W

Johnson Trading Post
T19N, R4W
T20N, R4W

Johnson Trading Post
T19N, R4W
T19N, R3W
Johnson Trading Post
Johnson Well
Arroyo
San Isidro
Wash
LANDING ST
Mammal Transect #BT 28
BT 28
BT 30
Raven nest 5/8/81
6700
6736
6661
6640
6636
6630
6603
6588
6600
6658
6721
6735
6612
6900
32
17
13
12
9
8
7
6
5
4
30



Prairie Dogs
BT 2
BT 3
Mammal Transect #9
Mammal Transect #9A
Drill Hole
Hollow Pit Tank
Tsosie
Wash
Betonnie
Kimbeto
T22N, R9W
12
13
18
17
16
8
9
24
19
20
21
6500
6400
6600
6340
6361
6439
6449
6544
6546
6541
6499
6518
6440
244
R. 10 W.
R. 9 W.
50'
246
(SARGENT RANCH)
4456 III SE
248
47'30"
249
SCALE 1:24 000
1 MILE



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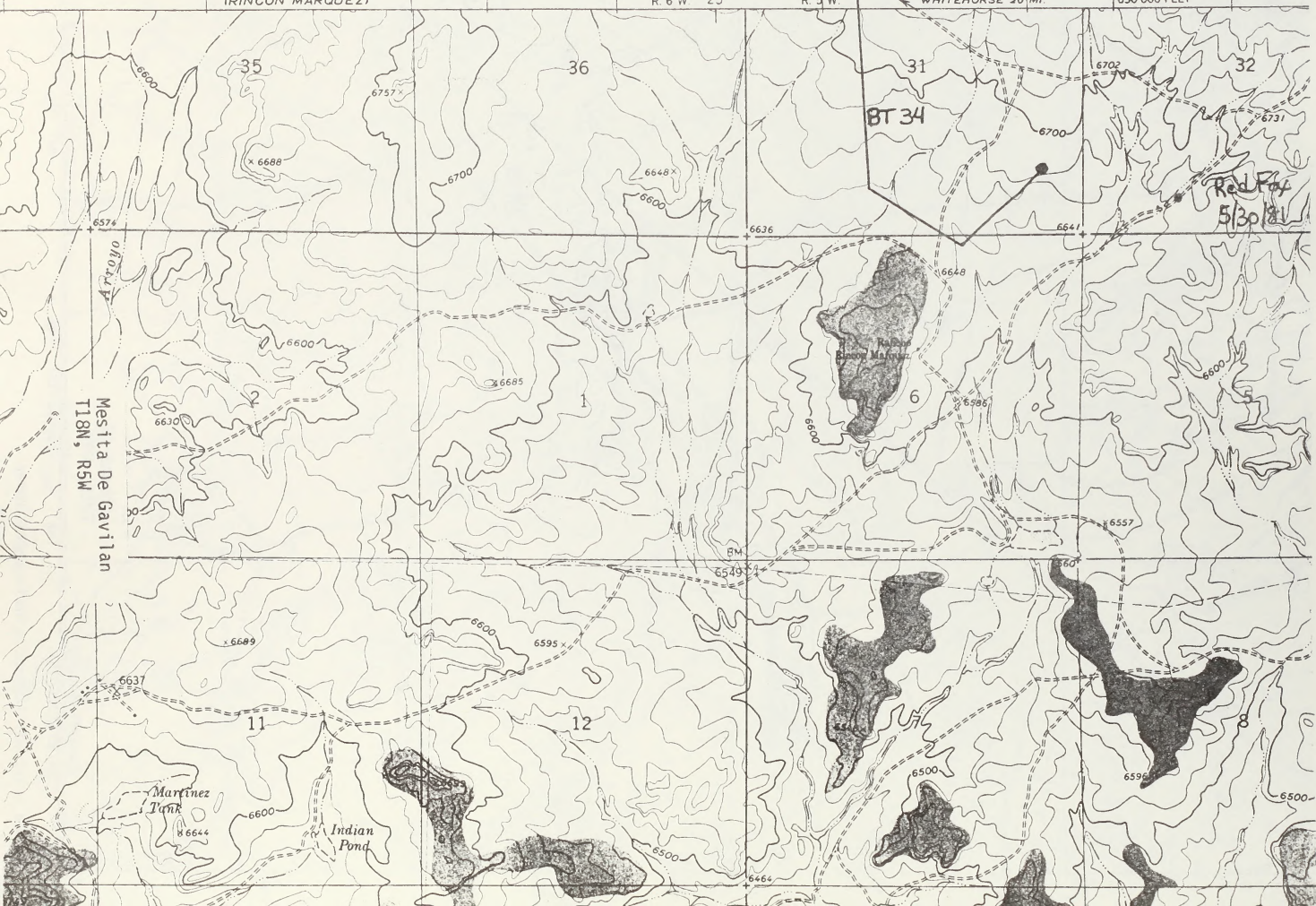
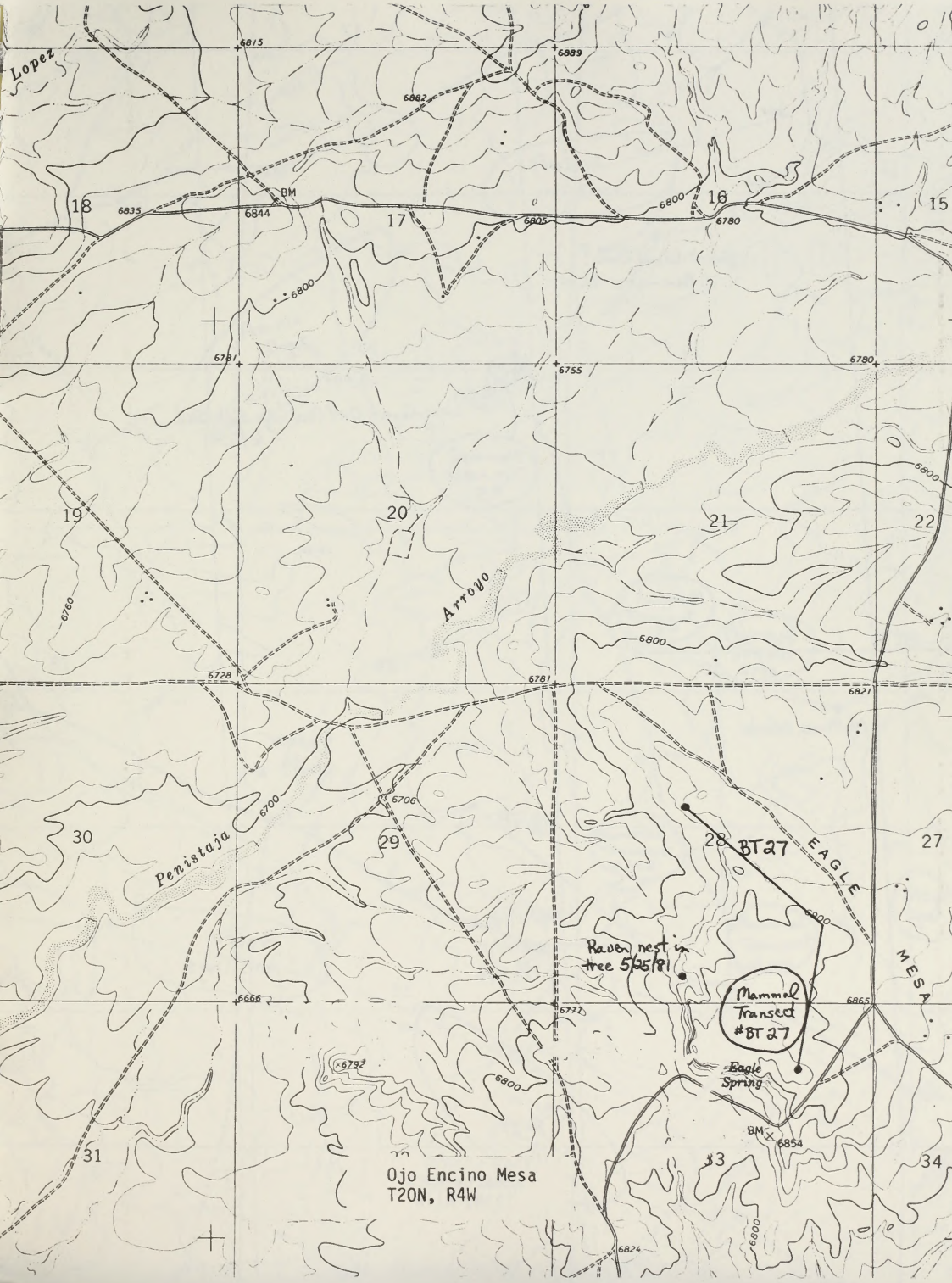
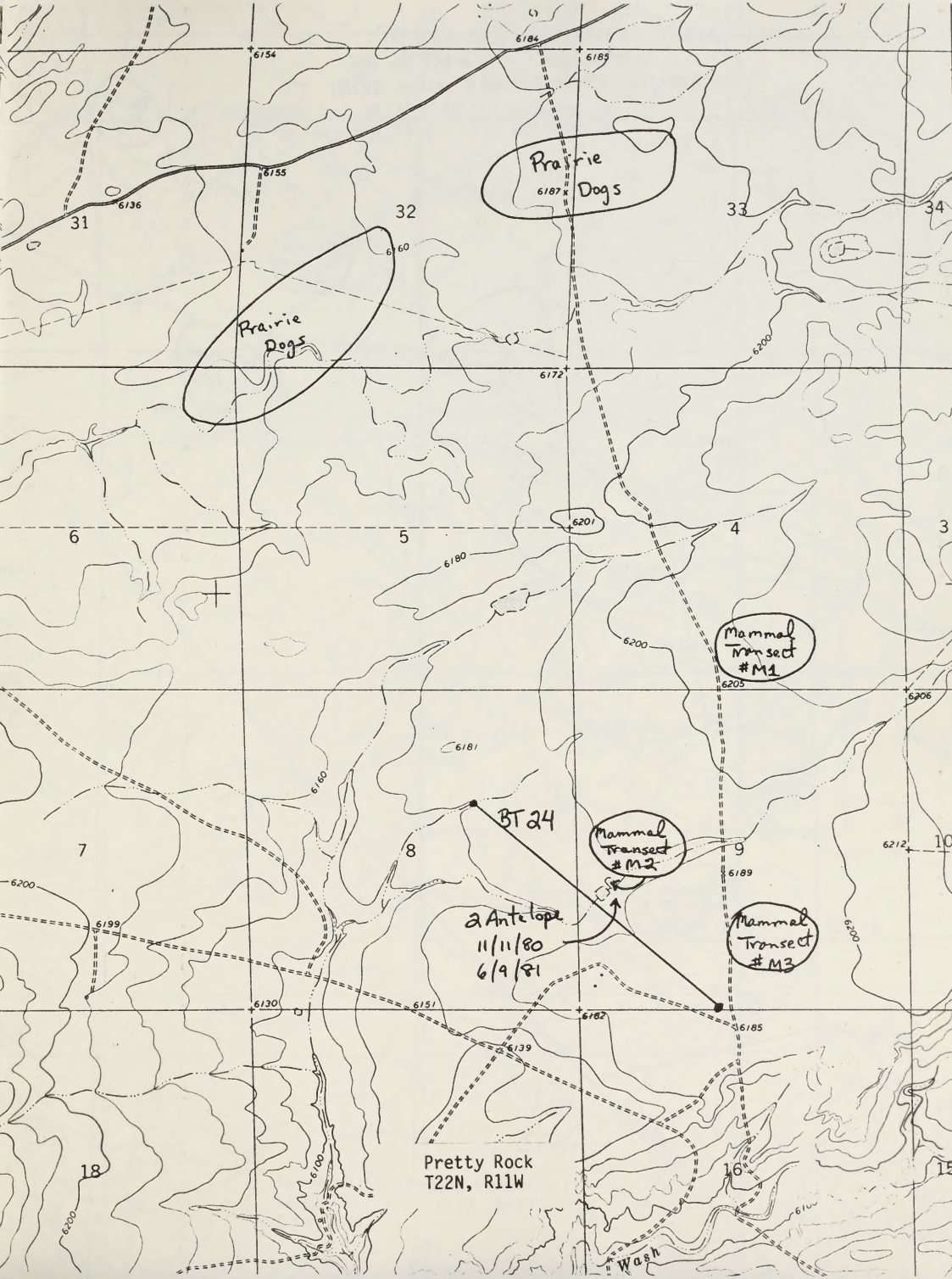
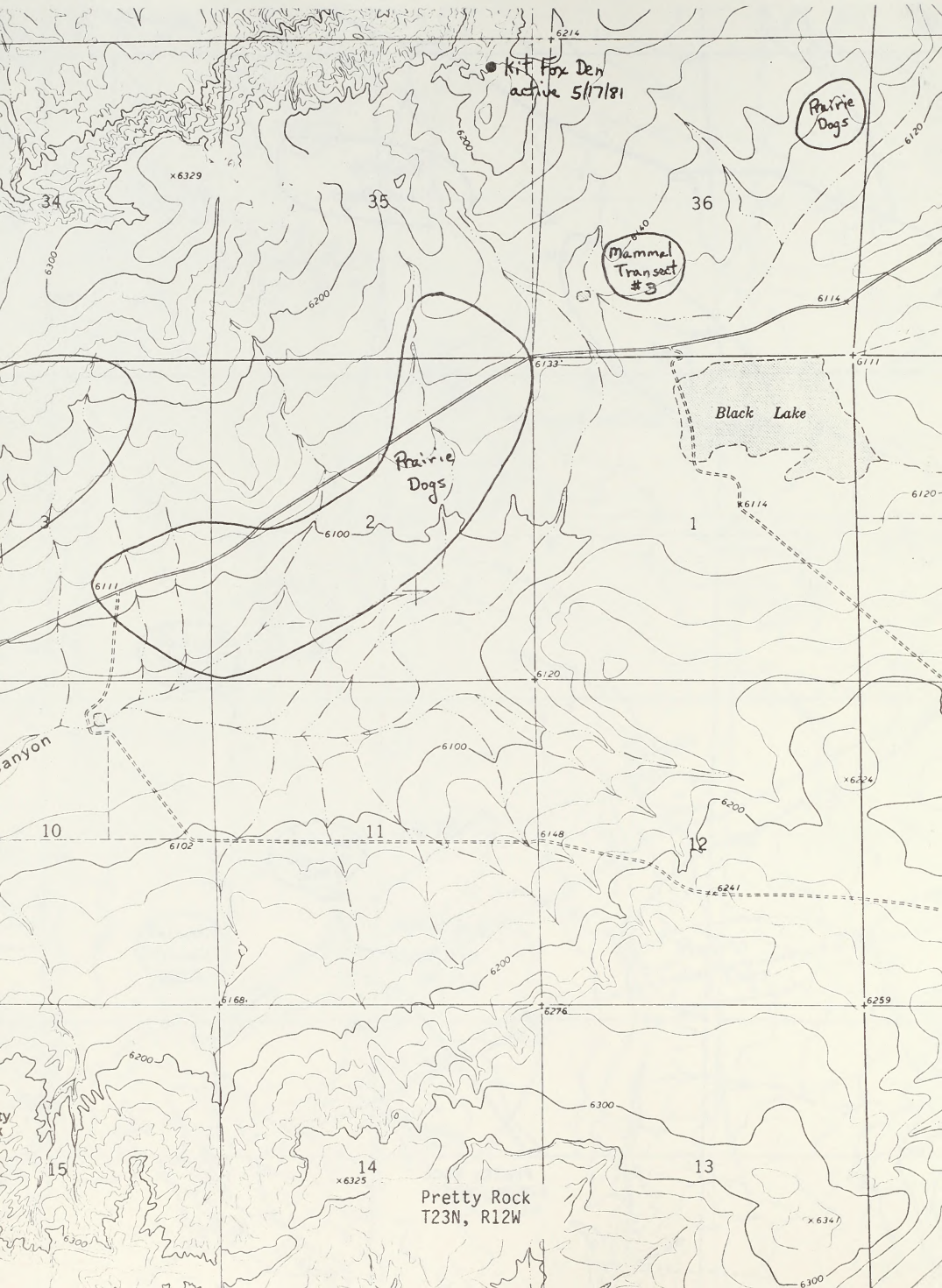
NEW MEXICO-M
7.5 MINUTE SERIES



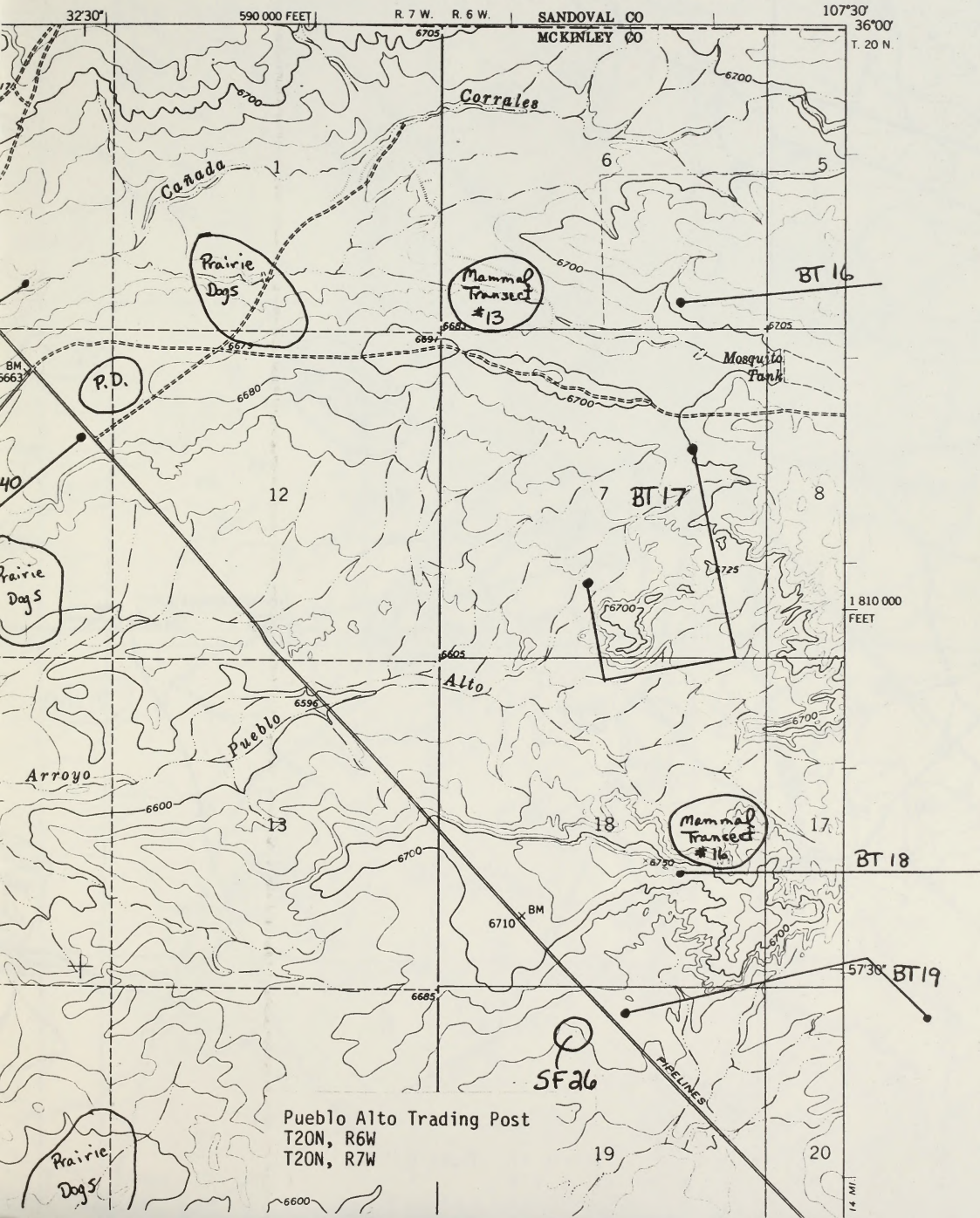

Lopez
6815
6889
6882
18
6835
BM
6844
17
6805
6800
16
6780
15
6800
6781
6755
6780
19
20
21
22
6800
Arroyo
6760
6800
6728
6781
6821
6700
6706
30
Penistaja
29
28
BT27
EAGLE
27
6900
Raven nest in tree 5/25/81
MESA
6666
6772
6865
Mammal Transect #BT27
6792
6800
Eagle Spring
BM
6854
31
33
34
6824
6800
Ojo Encino Mesa
T20N, R4W

18
17
16
6083
6111
6160
6165
6100
Short-Eared Owl?
J. Rammatta B.L.M.
19
20
Coal
Creek
Long-Eared Owl Castings Collected
6/5/81
Mammal Transect #5
6140
×6188
Mammal Transect #4
BT 8
30
29
28
Mt. Plover Defends
×6142
6141
6200
Badger
11/6/80
6184
6154
6185
Prairie Dogs
6120
6155
Prairie Dogs
6187
31
6136
32
33
6160
6114
Prairie Dogs
6111
6172
6200
Pretty Rock
T23N, R11W

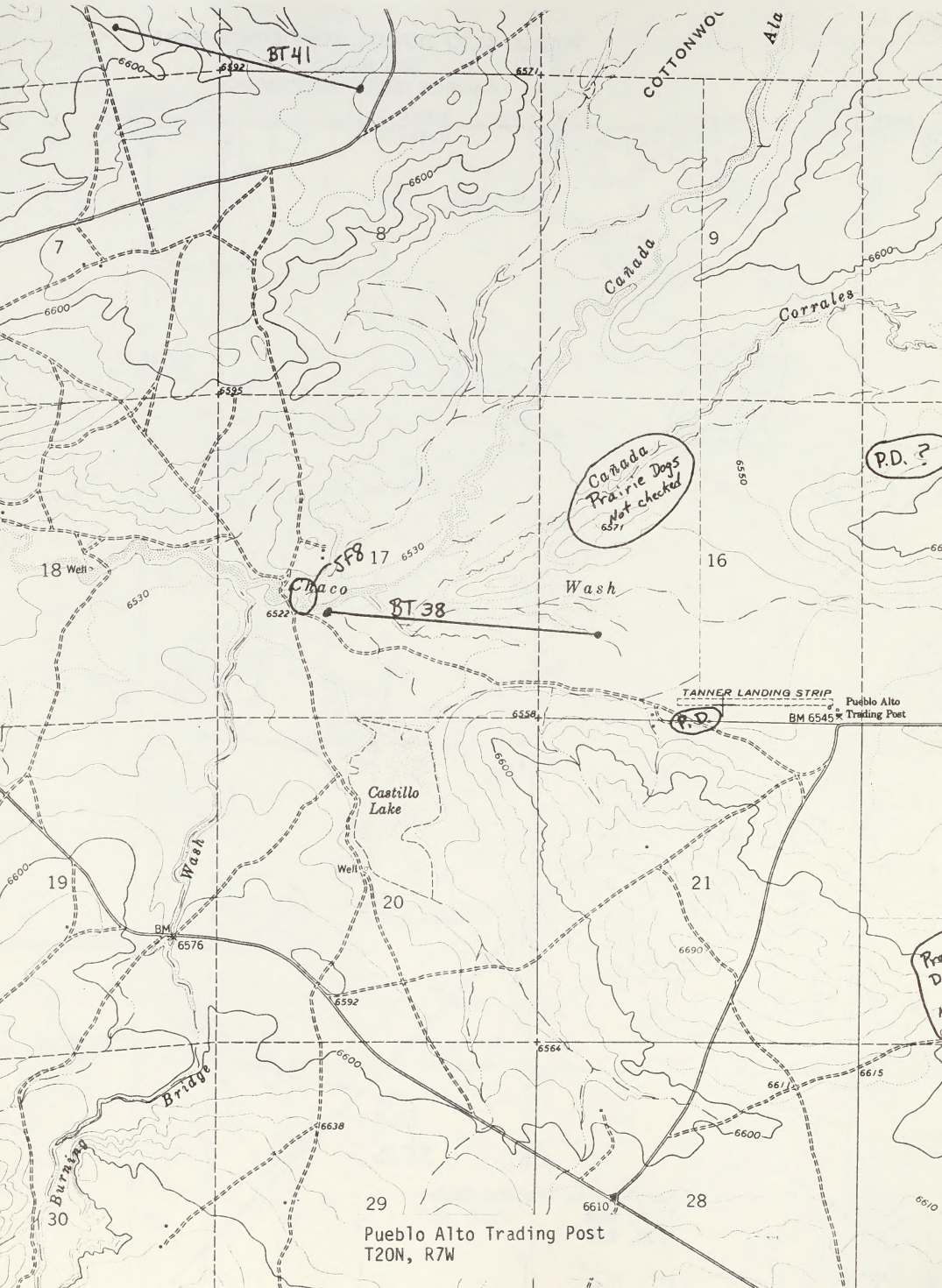

Prairie Dogs
Prairie Dogs
Mammal Transect #M1
Mammal Transect #M2
Mammal Transect #M3
BT 24
2 Antelope
11/11/80
6/9/81
Pretty Rock
T22N, R11W
Wash
31
32
33
34
6
5
4
3
7
8
9
10
18
16
15
6154
6184
6185
6155
6136
6160
6187
6200
6172
6201
6180
6205
6206
6181
6160
6212
6189
6199
6130
6151
6182
6185
6139
6100

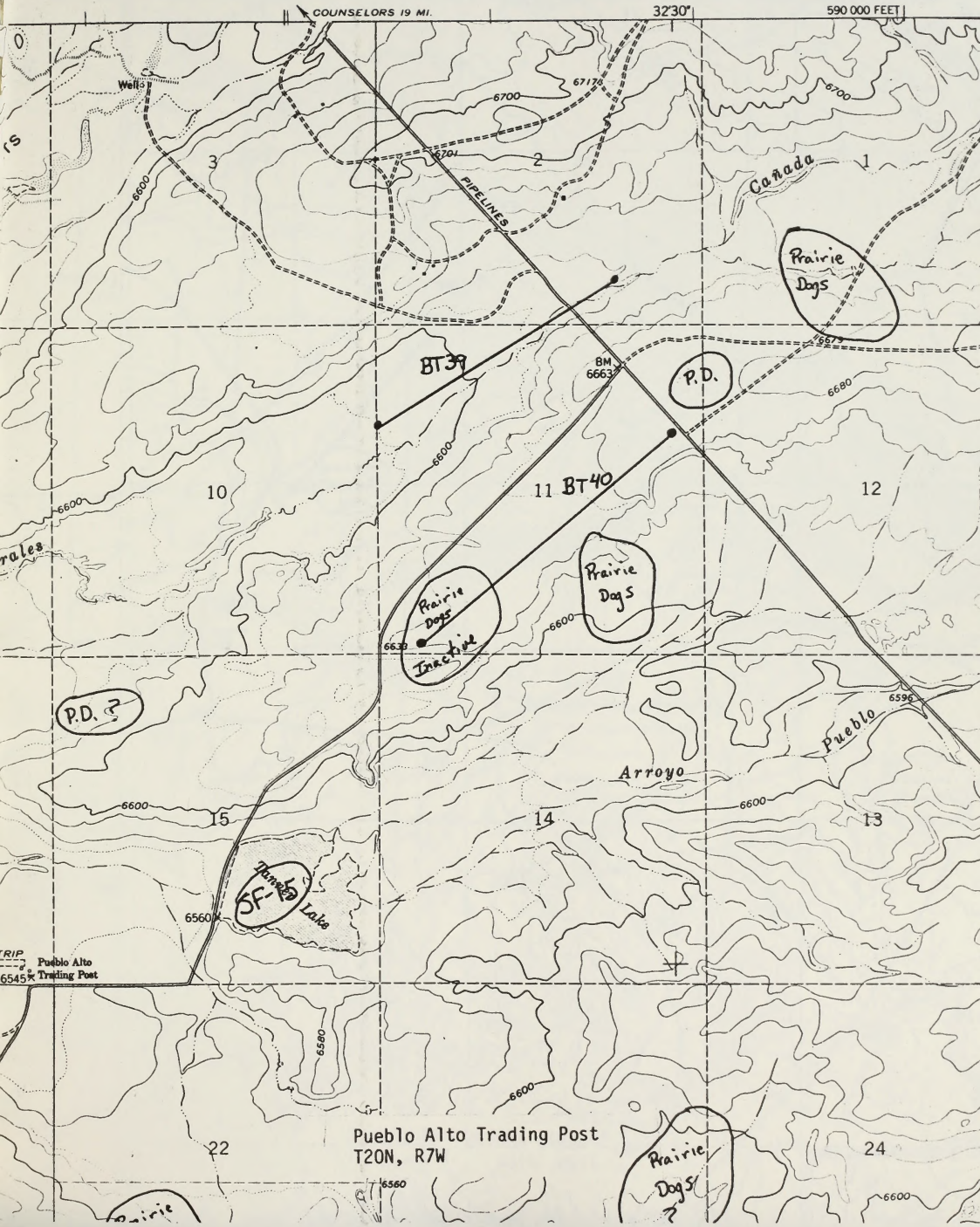

Kit Fox Den
active 5/17/81
Prairie Dogs
Mammal Transect #3
Black Lake
Prairie Dogs
Pretty Rock
T23N, R12W

PUEBLO ALTO TRADING POST QUADRANGLE
NEW MEXICO
7.5 MINUTE SERIES (TOPOGRAPHIC)



Pueblo Alto Trading Post
T20N, R6W
T20N, R7W

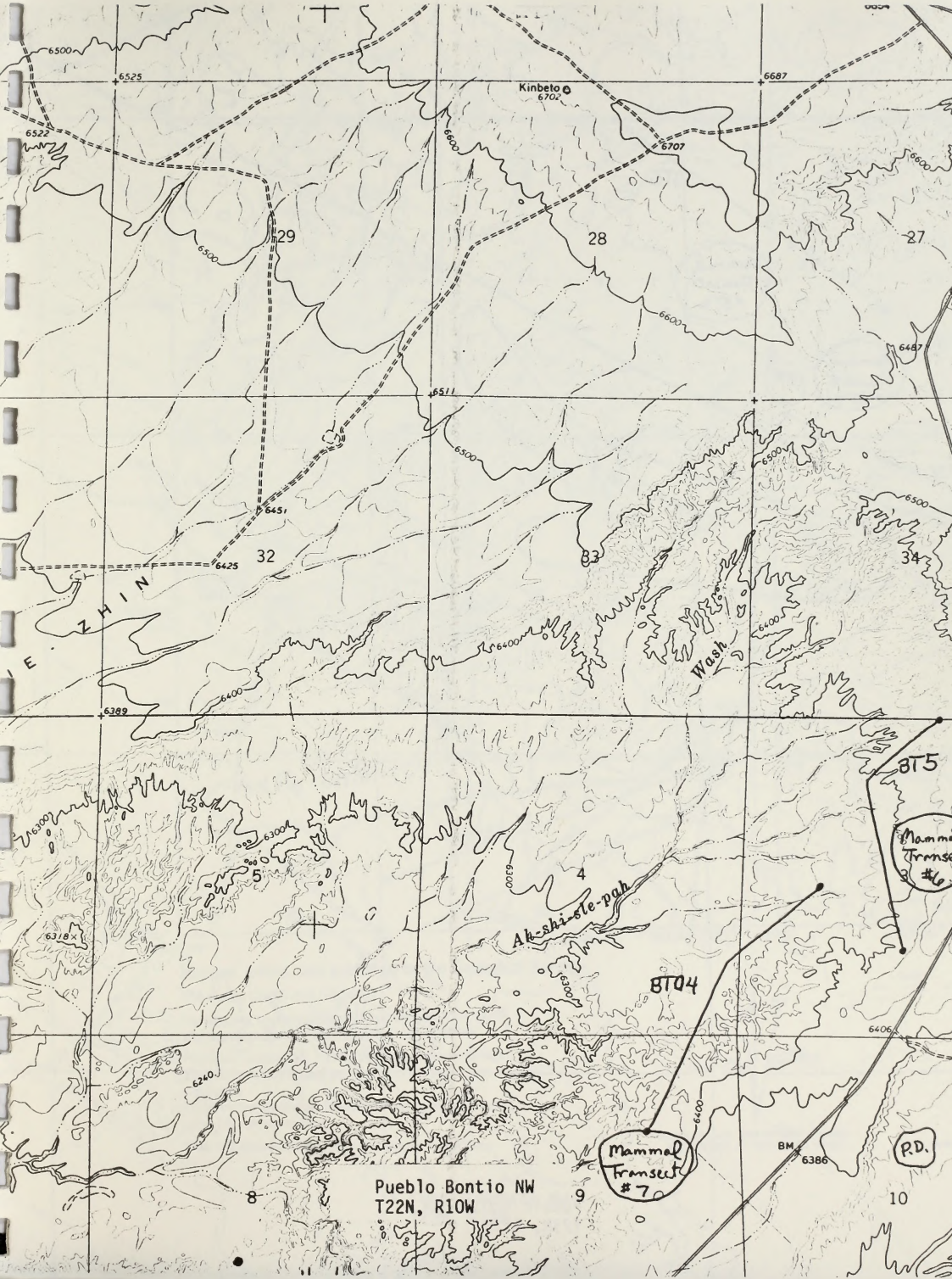

BT41
6600
6592
6571
COTTONWOO
Ala
6600
7
8
9
Cañada
6600
Corrales
6600
6595
Cañada
Prairie Dogs
Not checked
6571
6550
P.D. ?
18
Well
6530
SF8
17
6530
16
Chaco
Wash
6522
BT 38
TANNER LANDING STRIP
Pueblo Alto
Trading Post
BM 6545
6558
P.D.
6600
Castillo
Lake
Wash
Well
6600
19
20
21
BM
6576
6690
6592
6564
6600
6615
6611
Bridge
6638
6600
Burning
29
28
6610
6610
30
Pueblo Alto Trading Post
T20N, R7W



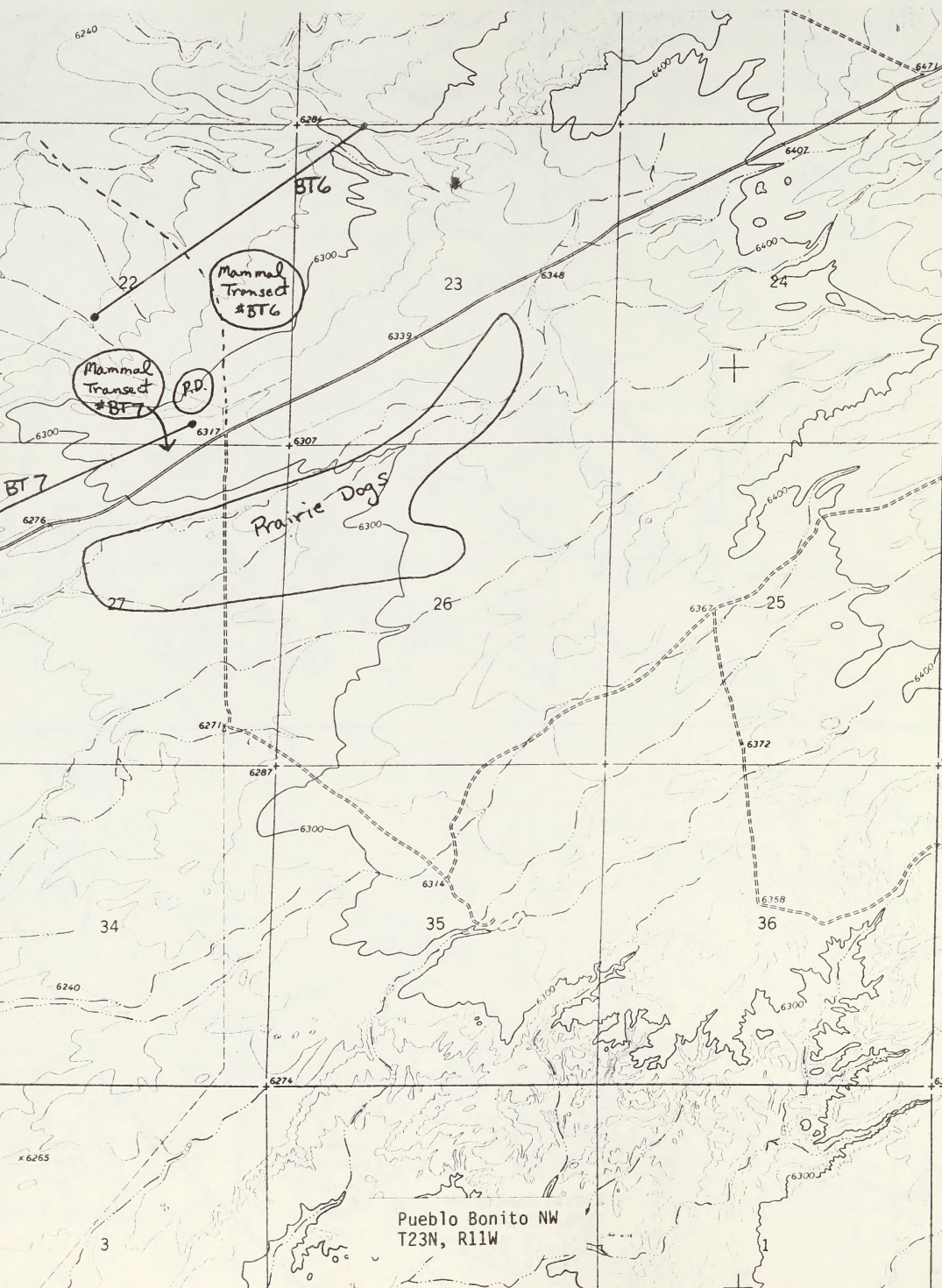
Pueblo Alto Trading Post
T20N, R7W

PUEBLO BONITO QUADRANGLE
NEW MEXICO
7.5 MINUTE SERIES (TOPOGRAPHIC)

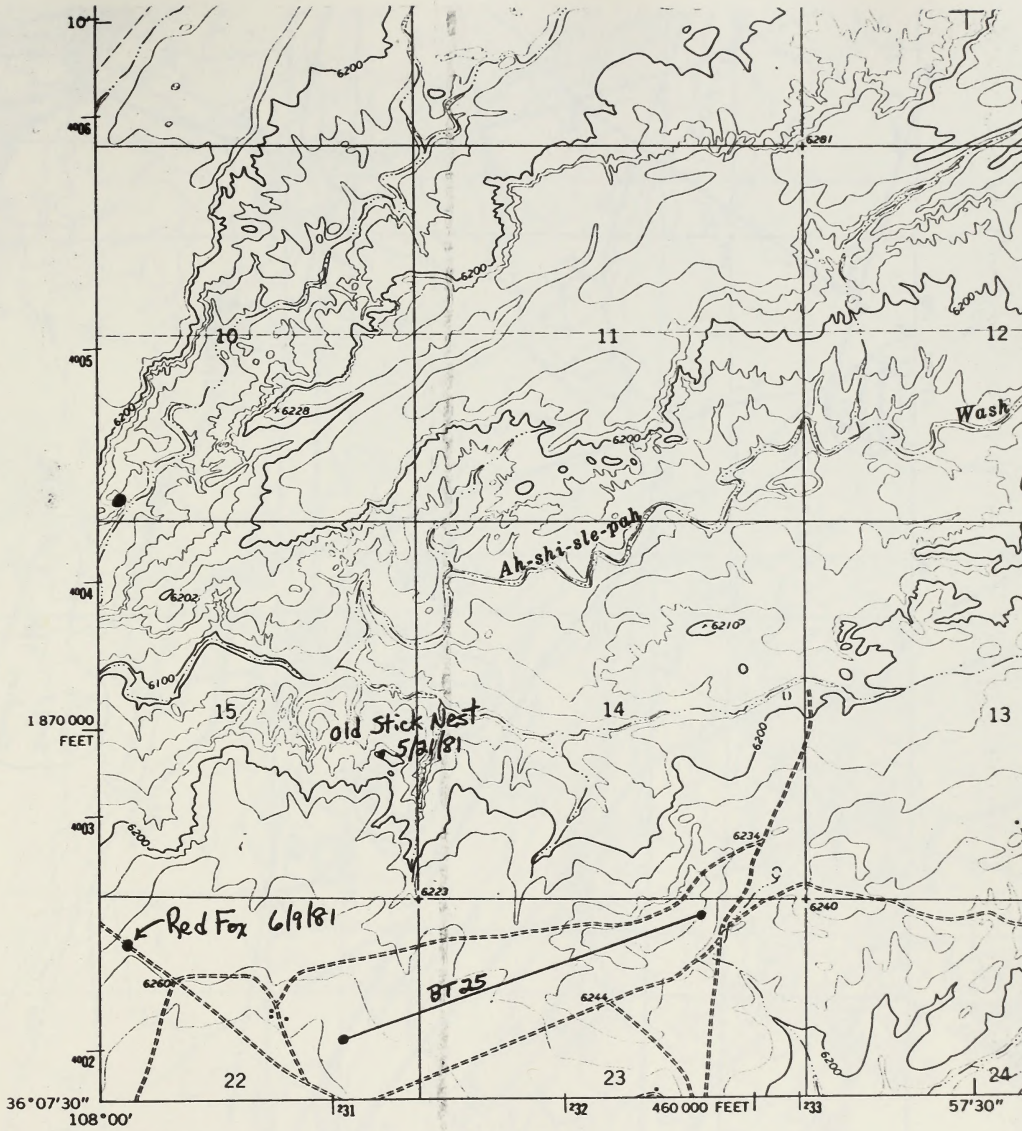
4456 III (KIMBETO)



Pueblo Bontio NW
T22N, R10W



Pueblo Bonito NW
T23N, R11W



(KIN KLIZHIN RUINS)
4356 II SE

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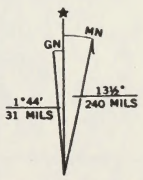
Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1965. Field checked 1966

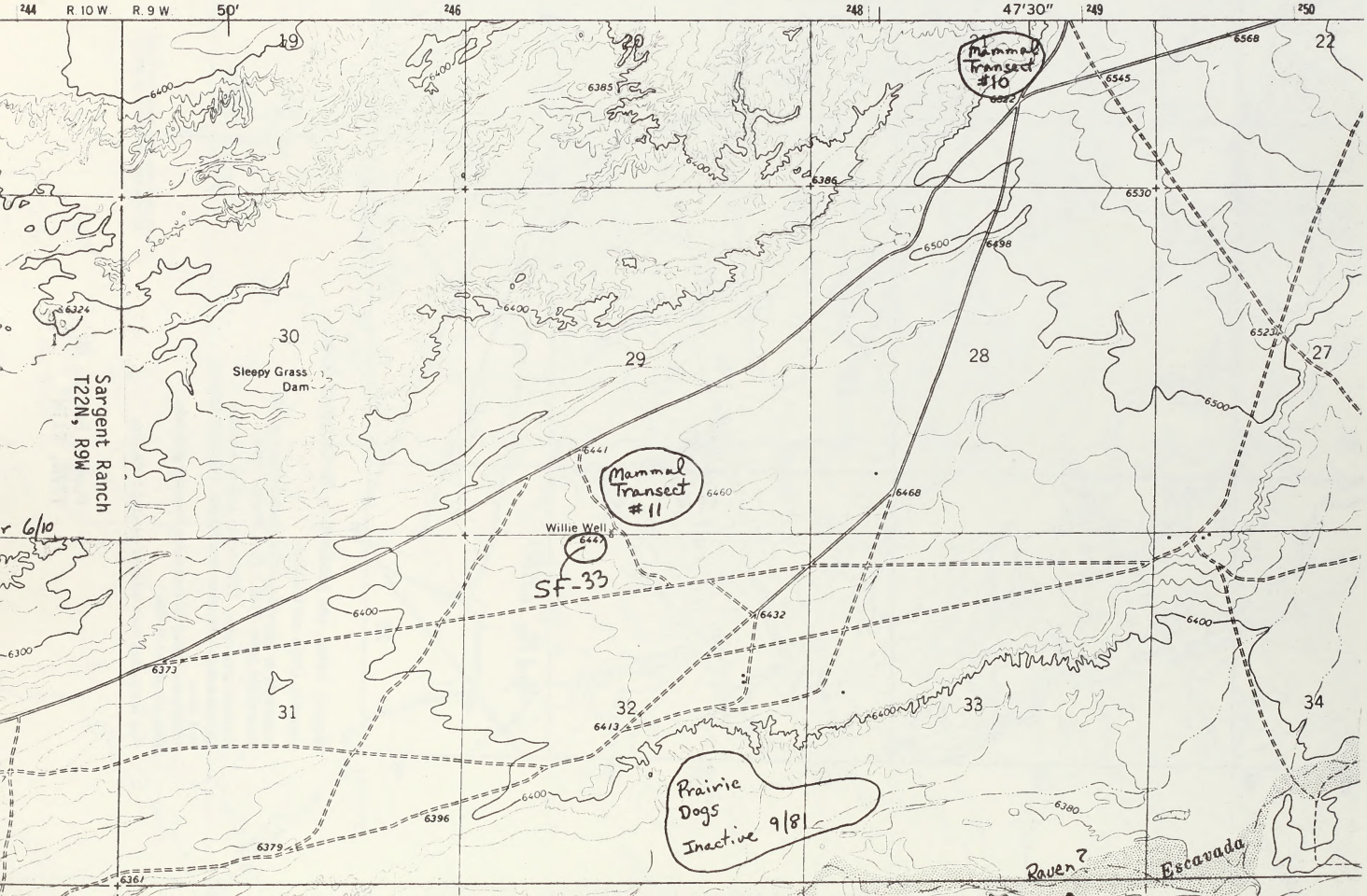
Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue

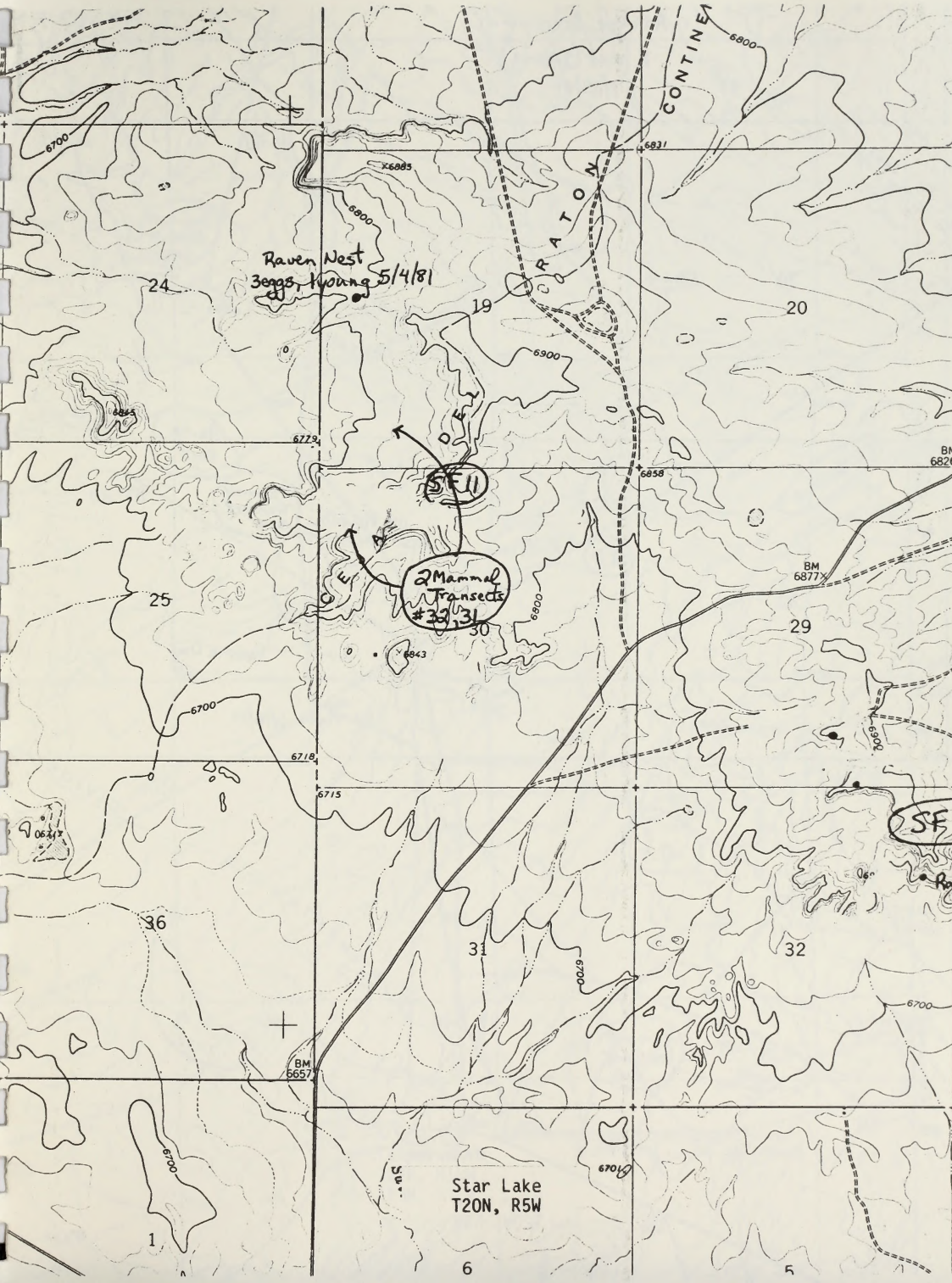
Fine red dashed lines indicate selected fence lines

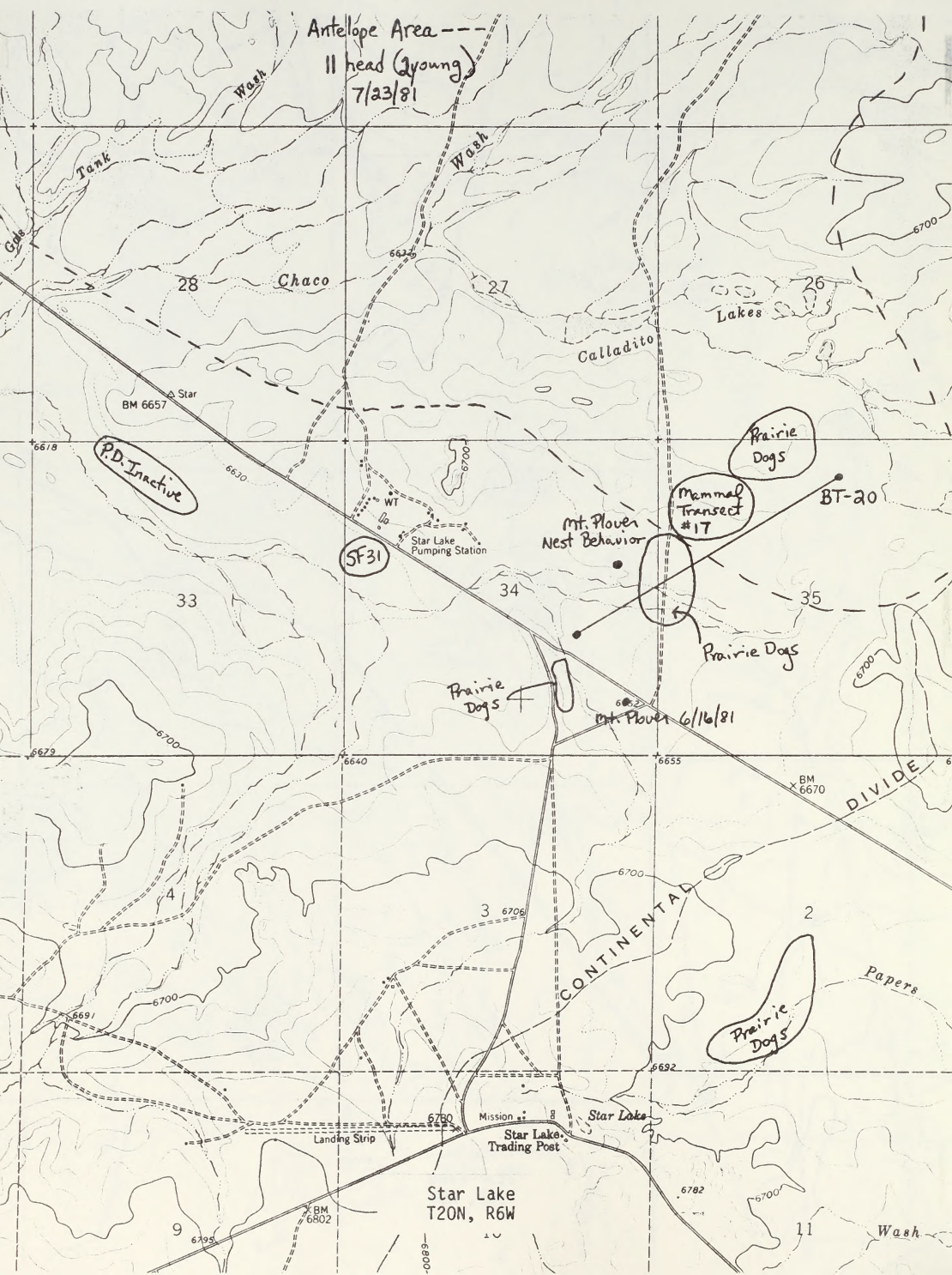


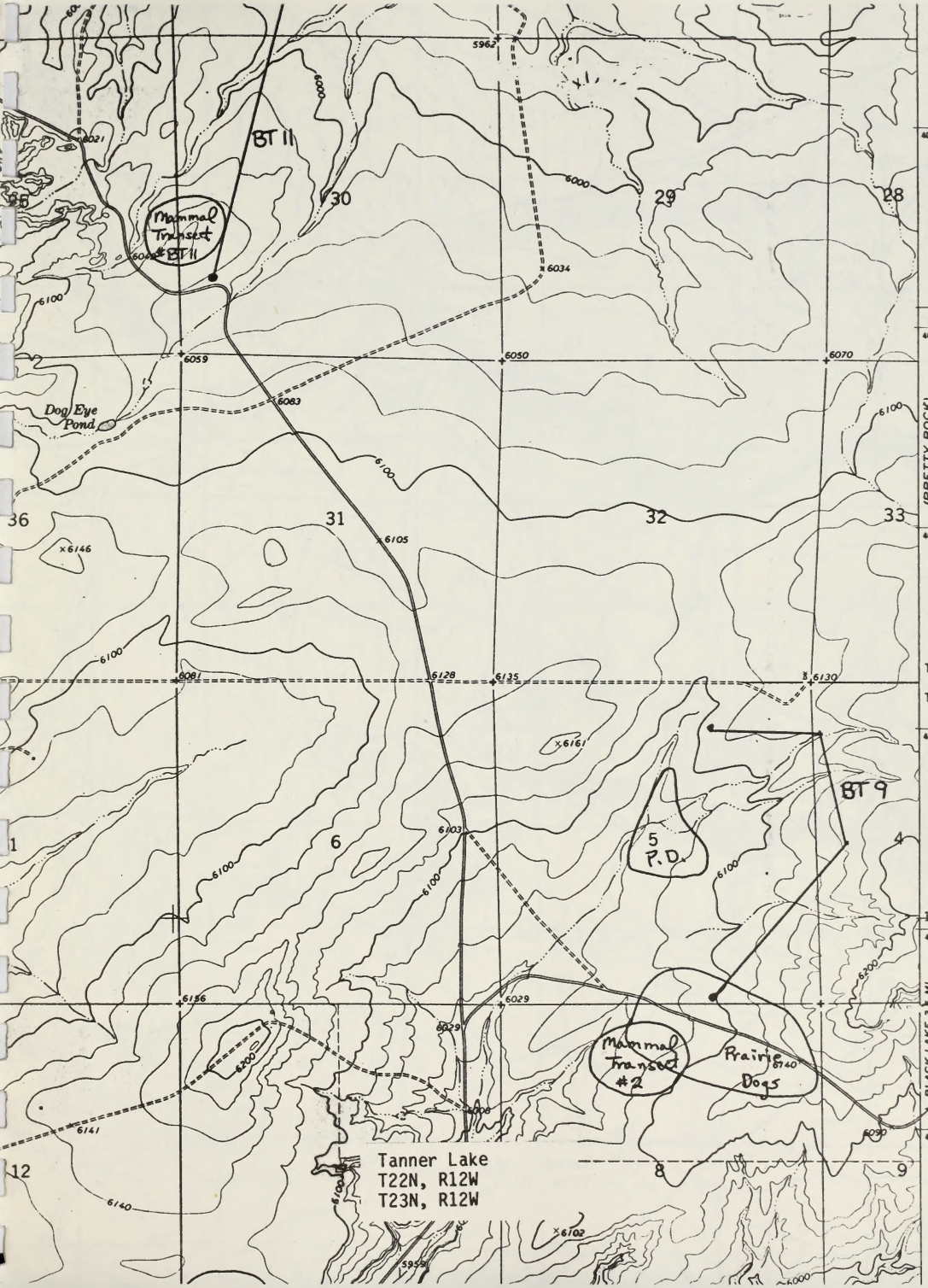
UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

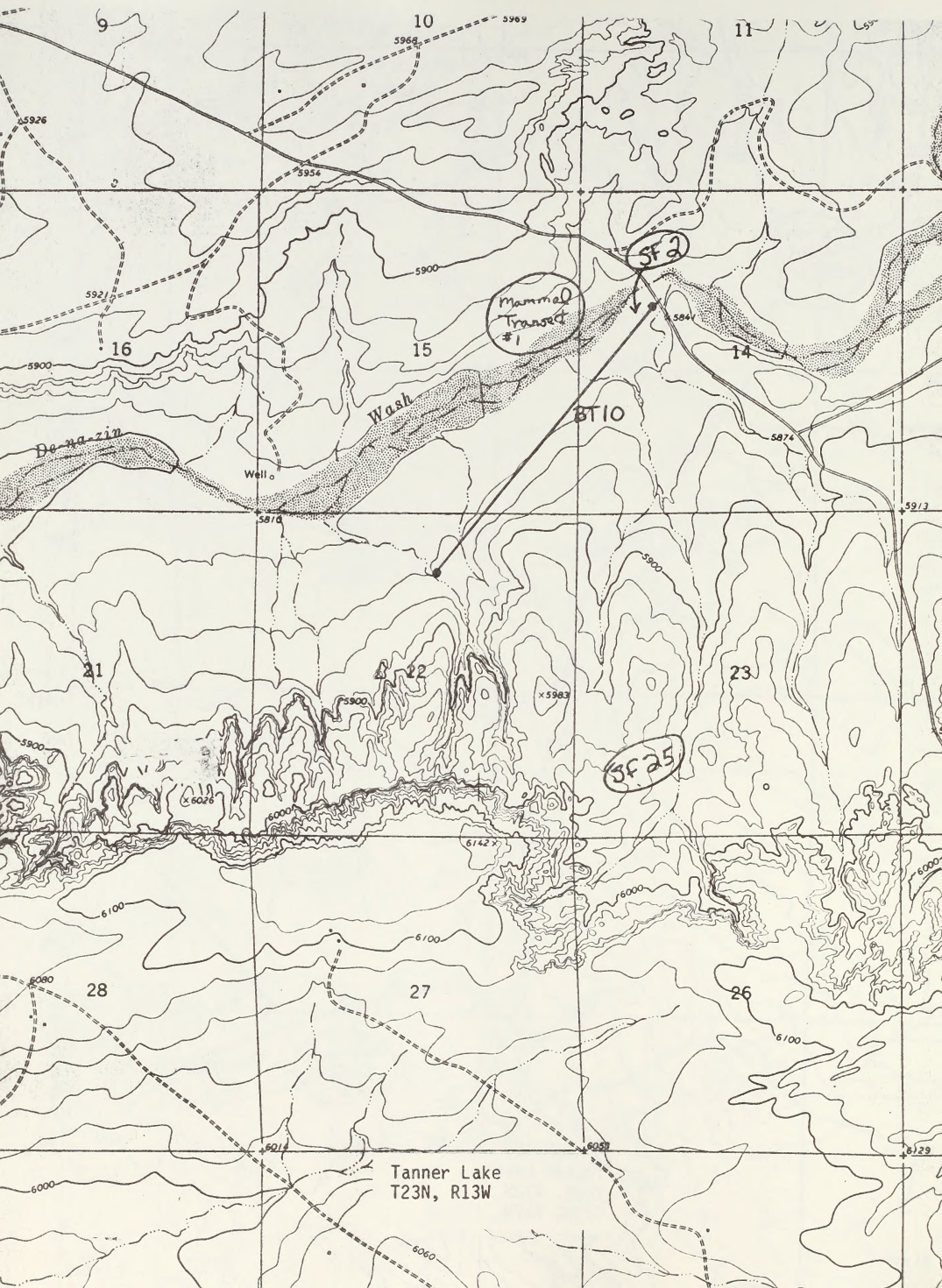
Pueblo Bonito NW
T22N, R11W

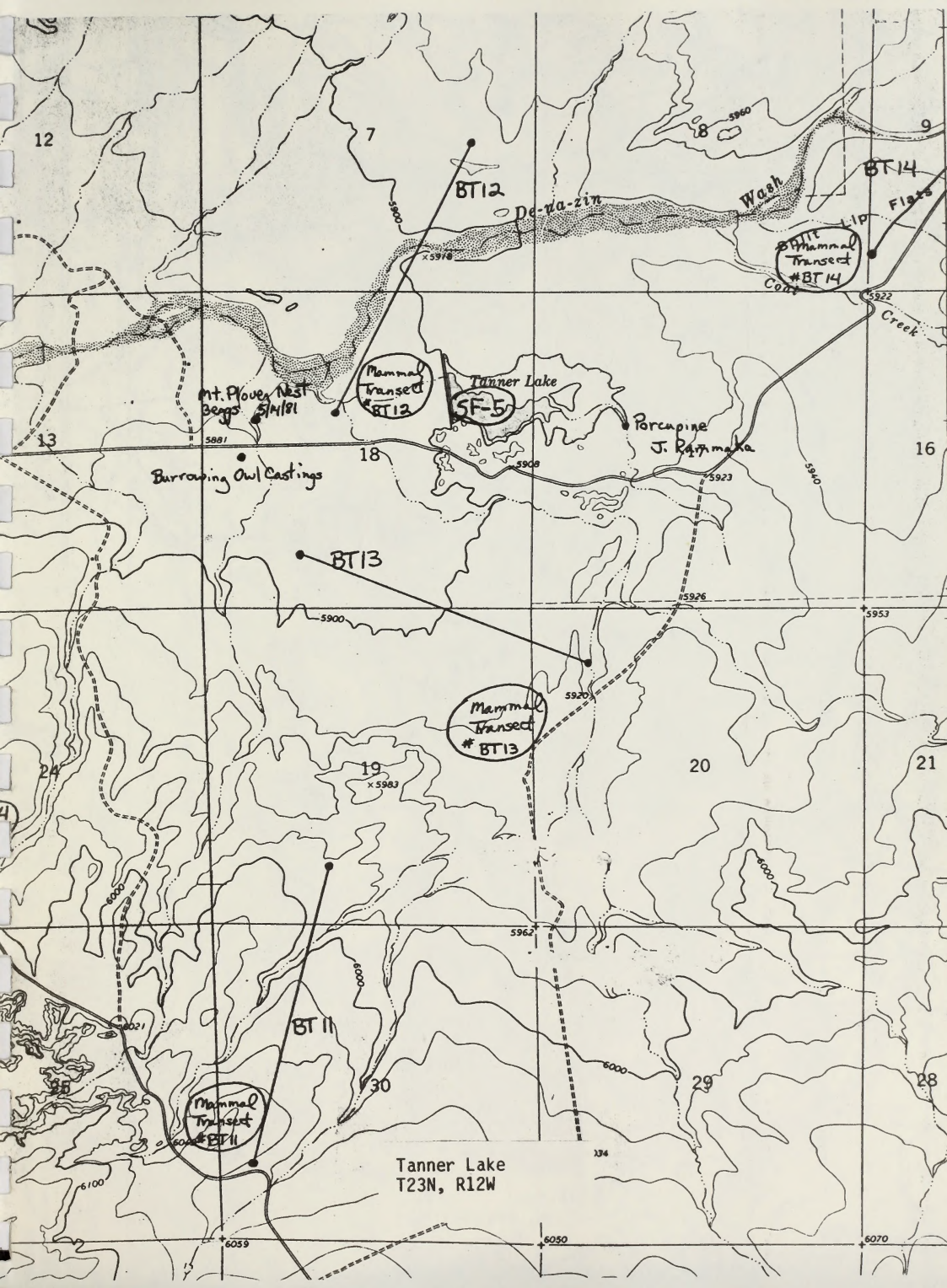

244
R. 10 W.
R. 9 W.
50'
246
248
47'30"
249
250
19
22
30
29
28
27
31
32
33
34
Sleepy Grass Dam
Sargent Ranch
T22N, R9W
Willie Well
Mammal Transect #10
Mammal Transect #11
SF-33
Prairie Dogs Inactive 9/81
Raven?
Escavada
6400
6385
6386
6568
6545
6530
6500
6498
6523
6324
6441
6460
6468
6449
6432
6373
6413
6396
6379
6361
6380
6300


Raven Nest
Beggs, Young 5/4/81
SF11
2 Mammal Transects
#32, 31
SF
Star Lake
T20N, R5W
24
19
20
25
30
29
36
31
32
1
6
5
6700
6800
6900
6779
6858
6718
6715
6657
BM 6877
BM 6657
6885
6865
6843
6831
6800
6700
6900
6701
6700
6700
6700

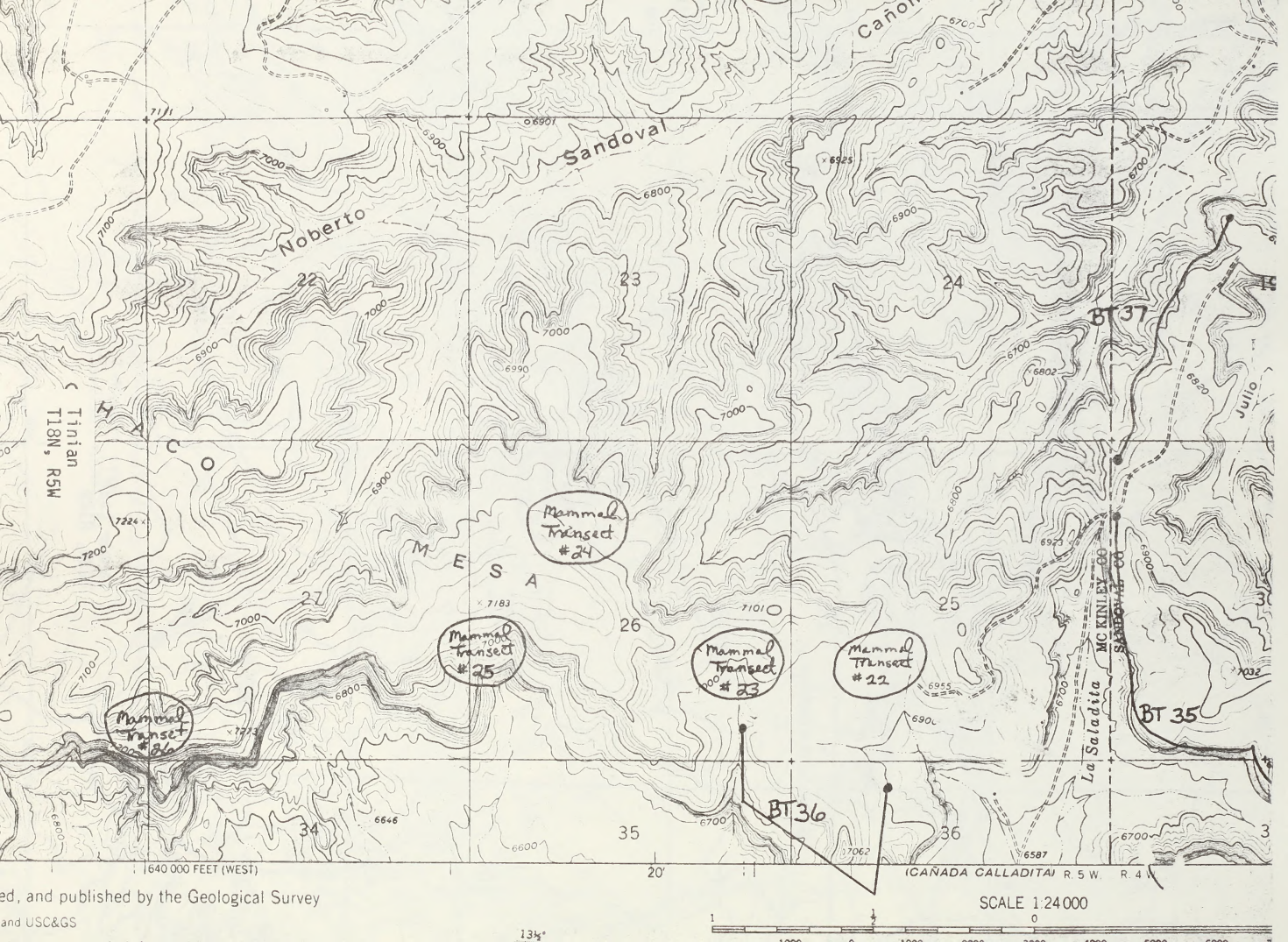

Antelope Area---
11 head (2young)
7/23/81
Wash
Tank
Gate
Wash
Chaco
28
27
26
Lakes
Calladito
BM 6657
Star
P.D. Inactive
Prairie Dogs
Mammal Transect #17
BT-20
Mt. Plover Nest Behavior
SF31
Star Lake Pumping Station
33
34
35
Prairie Dogs
Prairie Dogs
Mt. Plover 6/16/81
BM 6670
DIVIDE
CONTINENTAL
4
3
2
Papers
Prairie Dogs
Landing Strip
Mission
Star Lake Trading Post
Star Lake
Star Lake
T20N, R6W
BM 6802
9
11
Wash


BT 11
Mammal Transect #BT 11
Dog Eye Pond
BT 9
5 P.D.
Mammal Transect #2
Prairie Dogs
Tanner Lake
T22N, R12W
T23N, R12W
(PRETTY ROCK) 4356 II NE
BLACK LAKE 3.5 MI.
T. 23
T. 22


9
10
11
5969
5968
5926
5954
5900
5921
SF 2
Mammal Transect #1
5841
16
15
14
5900
Wash
BT10
De-na-zin
Well
5874
5810
5913
5900
21
22
23
5900
×5983
5900
SF 25
×6026
6000
6142×
6000
6100
6100
6080
28
27
26
6100
6014
6059
6129
6000
Tanner Lake
T23N, R13W
6060



12
7
8
9
BT12
De-na-zin
Wash
BT14
Flats
Lip
Mammal Transect #BT14
Coal
Creek
5960
5900
5918
5922
Mammal Transect #BT12
Tanner Lake
SF-5
Mt. Plover Nest Beggs 5/4/81
Porcupine
J. Rammaka
13
18
17
16
5881
5908
5923
5940
Burrowing Owl Castings
BT13
5926
5953
5900
5920
Mammal Transect #BT13
24
19
20
21
5983
6000
5962
6000
6021
BT11
6000
25
30
29
28
Mammal Transect #BT11
Tanner Lake
T23N, R12W
6100
6059
6050
6070



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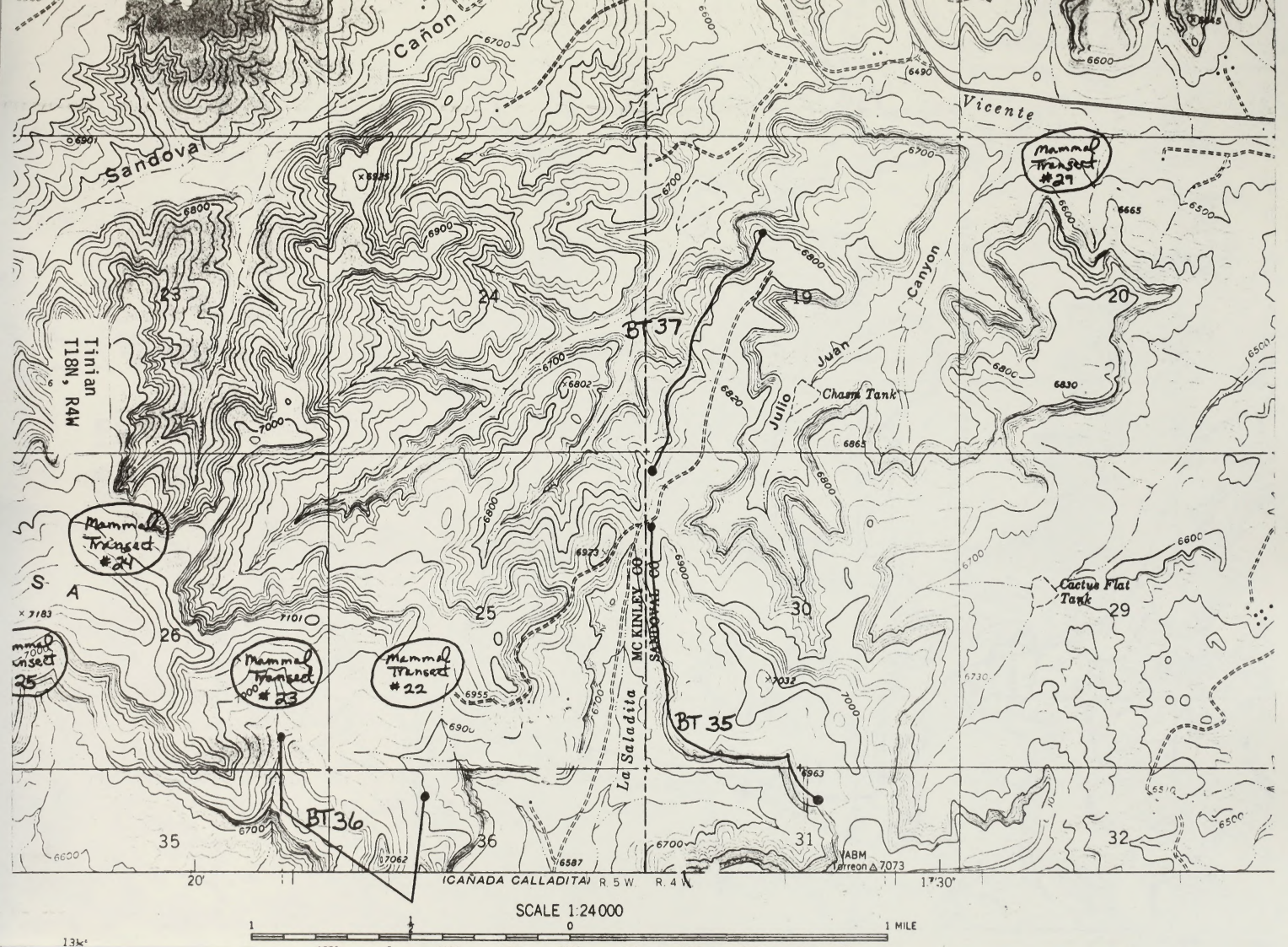
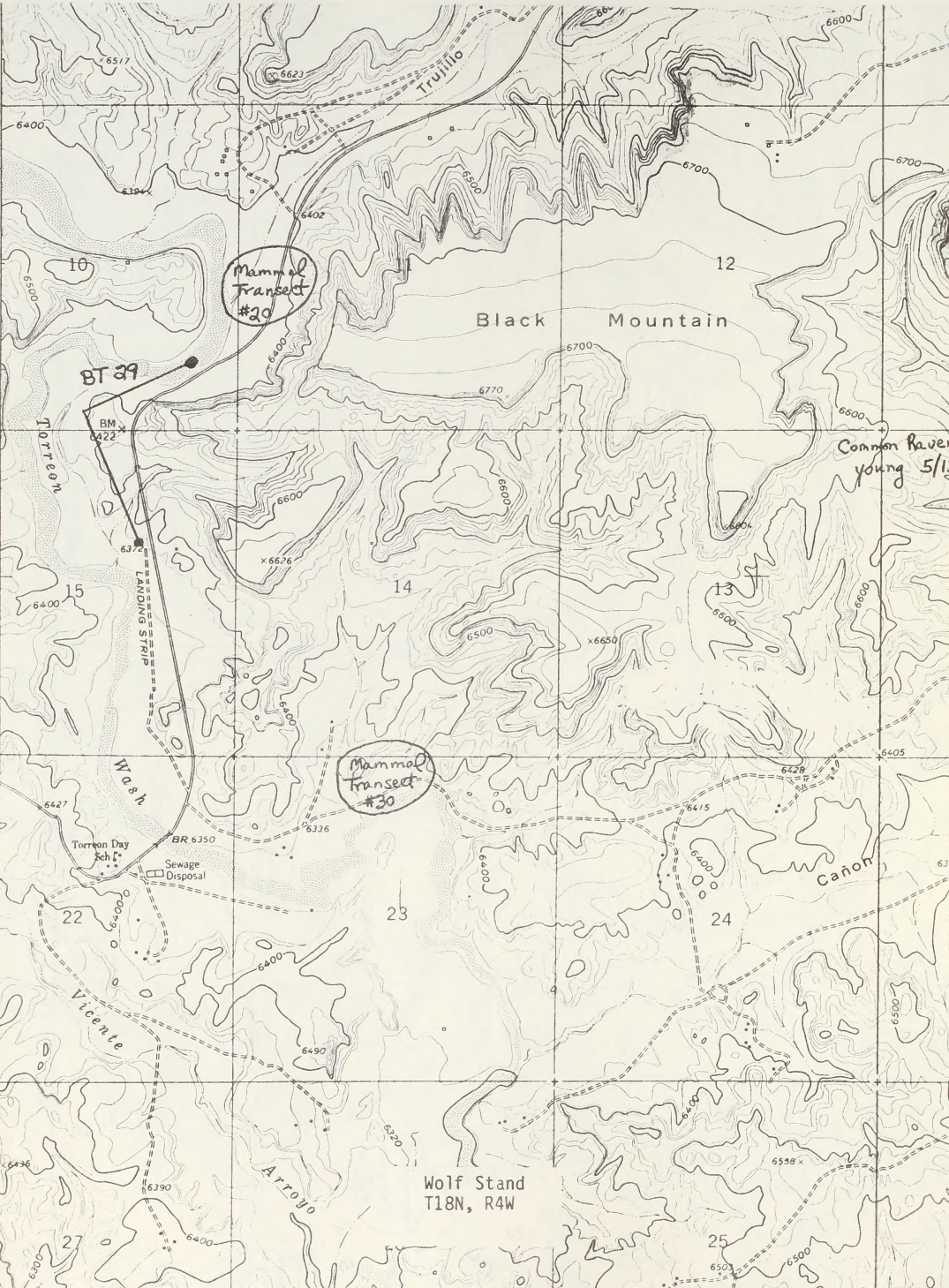


Cañon
Sandoval
Vicente
Tinian
T18N, R4W
Mammal Transect #29
Mammal Transect #24
Mammal Transect #23
Mammal Transect #22
Mammal Transect #25
BT 37
BT 35
BT 36
Julio Juan Canyon
Chasm Tank
Cactus Flat Tank
La Saladita
MC KINLEY CO
SANDOVAL CO
23
24
19
20
26
25
30
29
35
36
31
32
6901
6925
6800
6900
6700
6600
6490
6665
6500
6830
6865
6820
6802
6923
7101
7183
7032
6955
6963
7062
6587
6730
6510
VABM
Torreon △ 7073
20'
(CAÑADA CALLADITA) R. 5 W. R. 4 W.
17'30"
SCALE 1:24 000
1
½
0
1 MILE


Trujillo
Black Mountain
Mammal Transect #29
BT 29
Torreon
BM 6422
LANDING STRIP
Common Raven young 5/1
Mammal Transect #30
Wash
Torreon Day Sch
Sewage Disposal
BR 6350
Cañon
Vicente
Arroyo
Wolf Stand
T18N, R4W
10
11
12
13
14
15
22
23
24
25
27

R'S CARD

982
H.
rce inventory
strippable

OFFICE	DATE RETURNED

(Continued on reverse)

SK 427 .A434 1982
Albee, Michael H.
Wildlife resource inventory
of the Chaco strippable

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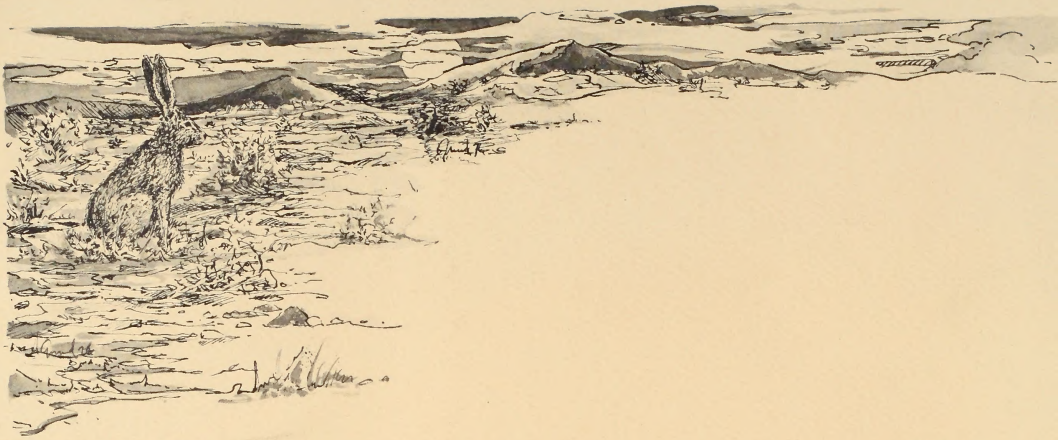

BIO/WEST, Inc.

P.O. Box 3226
Logan, Utah 84321

Art
by
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